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**Message from the Editor-in-Chief**

I am pleased to announce fourth issue of The Online Journal of Science and Technology (TOJSAT) in 2011. Fourth issue of The Online Journal of Science and Technology (TOJSAT) encapsulates different valuable researches from different fields.

As promoting knowledge sharing through valuable researches in the journal is the main mission, papers in the journal were selected through reviewing process. Therefore, I would like to thank to editorial board, reviewers and the researchers for their valuable contributions to the journal and this issue.

**October 01, 2011**

**Prof. Dr. Aytekin İŞMAN**

Editor-in-Chief of TOJSAT

**Message from the Editor**

Dear readers,

Now, we have reached the final issue of this year's volume. We have concluded the final issue as a candidate of this journal to the Science Citation Index. Many authors are seeking the appropiate science journal to be able to publish their valuable Works. On line journal are now accepting the papers to read and publish online . Next time, we will meet attandees in the 2nd international science and technology conference and many scientists will present their work and have a chance to give their work to publish in the journal. We will be very happy to see you in İstanbul.

**October 01, 2011**

Prof. Dr. M. Şahin DÜNDAR

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# ALUMINIUM HYDROGEN TUBE PROTOTYPE MANUFACTURING

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**Abstract:** This study includes production of high pressure resistant composite hydrogen tubes supported by R&D General Management of Ministry of Industry within the context of San-tez 123 Project.
In the context of San-tez 123 Project, for the first time in Turkish Industry, R & D activities were conducted and prototypes were produced for high pressure resistant storage tanks for hydrogen. In this study, behaviors of 6061, 6063 and 6082 alloys of the 6000 Al series have been investigated under high pressures which are used for manufacturing of tanks. Observations have been made for the quality criteria that tubes should provide.
**Key Words:** Al Mg Si alloys, high-pressure hydrogen storage tanks, high-pressure tank, finite element method analysis

## INTRODUCTION

Within the scope of San-tez 123 supported by the Ministry of Industry, R & D work for high-pressure hydrogen storage tanks had been done and the prototypes were produced for the first time in our country. In this study, behavior of 6000 series of Al Mg Si alloys which are being used in the manufacture of tanks 6061, 6063 and 6082 are examined with computer-aided finite element method (ANSYS) under high pressure. Hydrostatic pressure tests are done for each alloy which are produced for prototypes and the test results are compared with ANSYS results. In this study primarily nine different protype tubes are produced in order to investigate cases of three different heat treatments for three different alloys. These tubes were subjected to analysis by computer modeling. These produced samples are blown after hydrostatic pressure tests. The results were compared. For the ANSYS test done by computer tensile test samples are removed from the tanks, yield curves are obtained from the cross section of shaped tube and from these data is entered and the program. The aim of the study is to determine the ideal statu of alloy type and heat treatment. (Alnıak *et al.*, 2008; Alnıak *et al.*, 2009).

### High Pressure Resistant Composite Hydrogen Storage Tanks

In general, the structure of high-pressure hydrogen tanks is metal material inside and flat or helical type usually consisting of carbon fiber layers reinforcement. The general appearance of tanks storing hydrogen in the form of gas under high pressure as the general application of manufacturing is shown in Figure 1.
High-pressure tanks are divided into four categories;
Type 1 : Fully metallic tanks,
Type 2 : Glass wool-wound metallic tanks in general,
Type 3 : The tanks having initially glass fiber and than composite metallic material composed of carbon fiber in its interior part,
Type 4 : Basically, carbon-fiber composite tanks (inner part mostly consists of thermoplastic polymers) (Clefs cea, 2004)
Inner part which is called “liner” is obtained form tanks with many different methods. In the production of this interior part basicly deep drawing, extrusion, pressing, flow-forming methods are used. Method selection depends on the size of the investment and the form of the tank. After achieving a tank reinforcing wound layer is obtained from mechanisms which can be seen in Figure 1.



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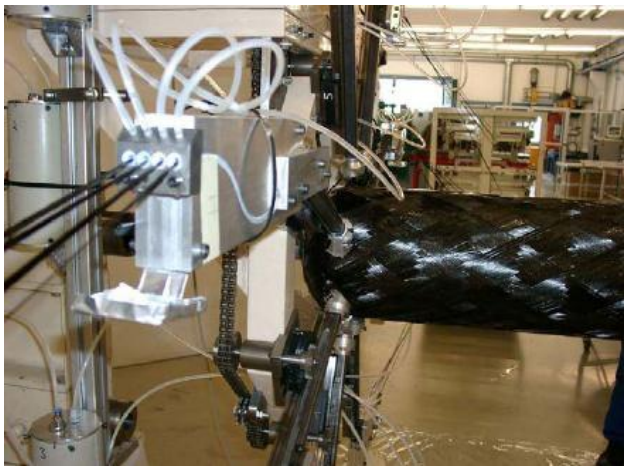

Figure 1. Wrapping of Carbon Fiber Supplementation on the Aluminum Tank (Rau and Colom, 2006)

Since the beginning of 2000, works have been done on the usage of hydrogen in vehicles. In this context, many prototypes are produced and after completion of tests vehicles brought in use. In many countries, there are hydrogen refueling stations.

**PROTOTYPE TUBE MANUFACTURING AT ELEVATED TEMPERATURES**

High-pressure hydrogen tanks are manufactured with flow-forming method in serial production. But in this study since the high investment cost for machine is high, spinning, extrusion and end closing with press techniques are used in the manufacturing. In the first stage, cylinder shaped material should be waited in the furnace until it reaches the forming temperature. Than as shown in Figure 2, first shape will be given between molds for a hollow cylinder shape. In this stage, scotch is placed into female mold and male mold begins to move towards down along stroke.

Figure 2. Getting a hollow cylinder shaped as a container from a filled cylinder by the help of a press

With the pressure of male mold, the material in the female mold is plastered on the male mold. In the first stage with the help of press a draft hollow cylinder is obtained from full material. In the next stage the length of the tank will be extended by reducing the wall thickness with height extension process as shown in Figure 3.



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Figure 3. View of extension process

At this stage, the tank is forced to move a little lower matrix than the outer section's scale. With the effect of force the material starts to flow backward (indirect flow-forming). Thus, despite a decrease in cross-section of material extends throughout the tank. As can be seen in figure 4, after first forming process (press) and the second forming process (indirect flow-forming), thickness of the material is decreasing, but the length is increasing approximately two times. In addition, the material has become directed and more homogeneous in internal structure.

Figure 4. The comparison between first forming process and second forming process

Finally, the head of the extended tank is shrinked with the help of press in the molds. As seen in the Figure 5, material accumulation is occured during the shrinking process.



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Figure 5. Shrinking process for end part of the Aluminum-hydrogen tank

In this study, first as a liner for the sample tanks were produced for 3 different 6000 series aluminum material. These samples are obtained in 9 ways without heat treatment, with T4 and T6 heat treatment and 3 different samples are taken from each sample. All the mechanical properties obtained from 27 tensile tests are used in the finite element analysis in computer. Liner tanks are subjected to hydrostatic pressure test and the results were compared to results obtained from ANSYS. For the last test, carbon-fiber wrapped on the liner and subjected to hydrostatic pressure test and the results are discussed. Linear dimensions of the tanks used in the experiments are as shown in Figure 6;

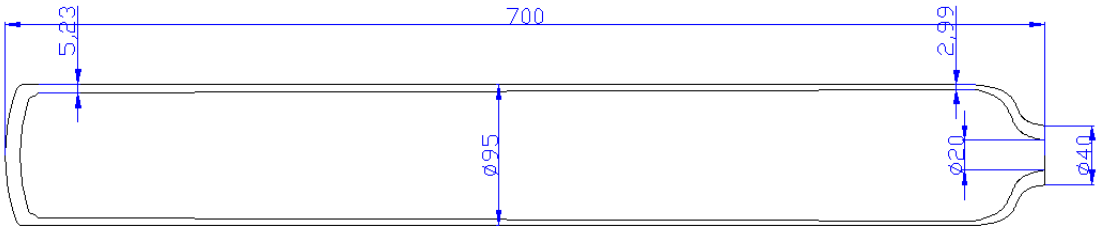


Figure 6. Tank Dimensions

**Features of Tanks Used in The Experiments**

Three different heat treatments is subject to availability for samples which are used in experiments;

F: The version after fabrications (manufactured) This condition; without any further action in order to change the strength or stiffness, refers to the physical structure after being manufactured.
T4: Solution heat treatment is applied and brought to steady state with natural aging. (500-525 ° C - 5 hours - rapid cooling in water)
T6: Solution heat treatment is applied and hardened with artificial aging (thermal heat treatment) (170-175 ° C - 12 hours of rapid cooling in water.
Metallurgical properties after primer production of 6XXX series aluminum alloys which is prepared for using in the experiments are shown in Table 1(Anonymous, 2009).
Chemical composition limits of EN-AW 6060 and EN-AW 6063 alloys which are typical 6XXX alloys are shown in Table 1. (EN 573-3 , Taken from Table 6)

Between 6XXX series alloys most commonly used alloys are 6060, 6063 (according to EN and new TS) and AlMgSi0.5 (according to DIN and old TS). These are generally the same as the chemical composition but some nuances may be seen.



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Table 1: Chemical composition of Aluminum alloys 6060 and 6063 (Anonymous, 2009).

| Element | EN AW 6060 | EN AW 6063 |
|---|---|---|
| **Si :** | 0,30 - 0,6 | 0,20 - 0,60 |
| **Mg :** | 0,35 - 0,6 | 0,45 - 0,90 |
| **Fe :** | 0,10 - 0,30 | 0,35 (max.) |
| **Cr :** | 0,05 | 0,10 (max.) |
| **Cu :** | 0,10 | 0,10 (max.) |
| **Zn :** | 0,15 | 0,10 (max.) |
| **Mn :** | 0,10 | 0,10 (max.) |
| **Ti :** | 0,10 | 0,10 / (max.) |
| **Other :** | 0.05 % max.<br>each total 0.15 % max. | 0.05 % max. each<br>total 0.15 % max. |

**Tensile Test**

Pulling curves were obtained from tanks by preparing tensile test samples for tank modeling in ANSYS and linear static analysis. The samples were prepared in wire erosion machines. 3 samples are taken from the surface of the tank in longitudinal direction and their avarage is taken. Specimens for the tensile tests are prepared according to TS 138 EN 10002-1 (Test piece type of: 1). The sample sizes are shown in Figure 7.

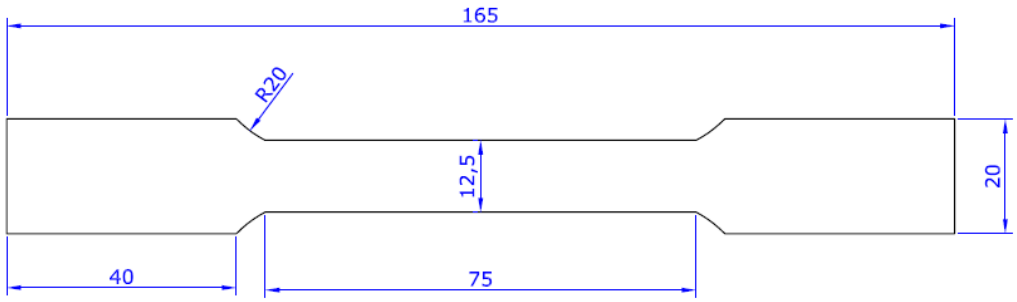


Figure 7. Dimensions of the tensile test samples coming out from the pipe according to TS 138 EN 10002-1

Graphs generated according to tensile test results are shown in Figure 8.



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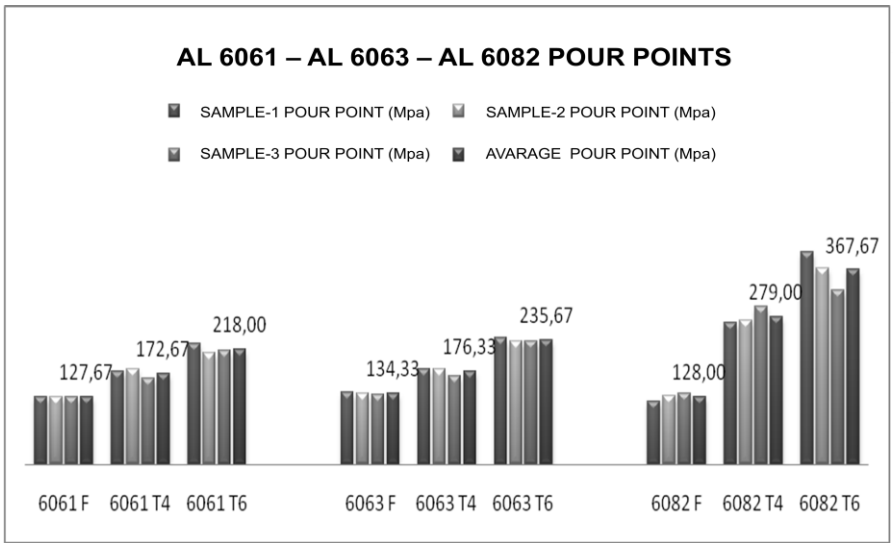


Figure 8. Pour Point Results Of Al 6061-Al 6063-Al 6082 Alloys Obtained By Tensile Tests

**2.3. Finite Element (Ansys) Analysis**

Finite element analysis was carried out with ANSYS software.

As an example bar pressure stress distribution of the tank which had AL 6082 T6 heat treatment is shown Figure 9.

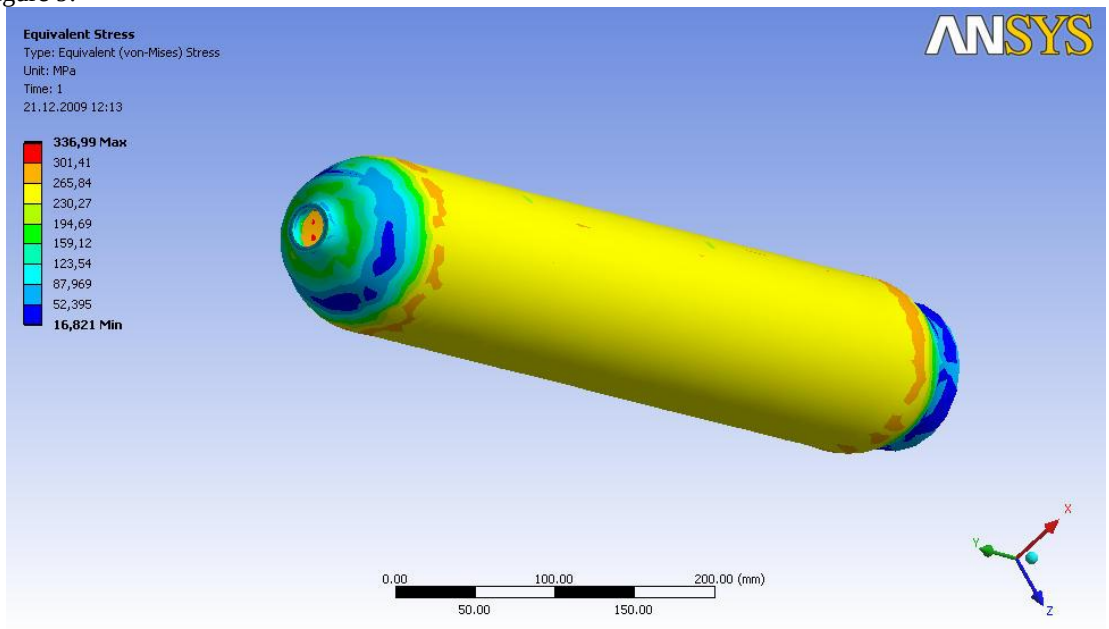


Figure 9. 6082 T6 201 Bar ANSYS Equivalent Stress Results

**2.4. Hydrostatic Pressure Tests**

Hydrostatic pressure tests for samples were carried out in Aygaz facilities in Gebze. A sample application after ruture tests is shown in Figure 10. Explosion pressure values of all samples are shown in Figure 11.



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Figure 10. View of 6061 T6/1 Sample After Hydrostatic Pressure Test

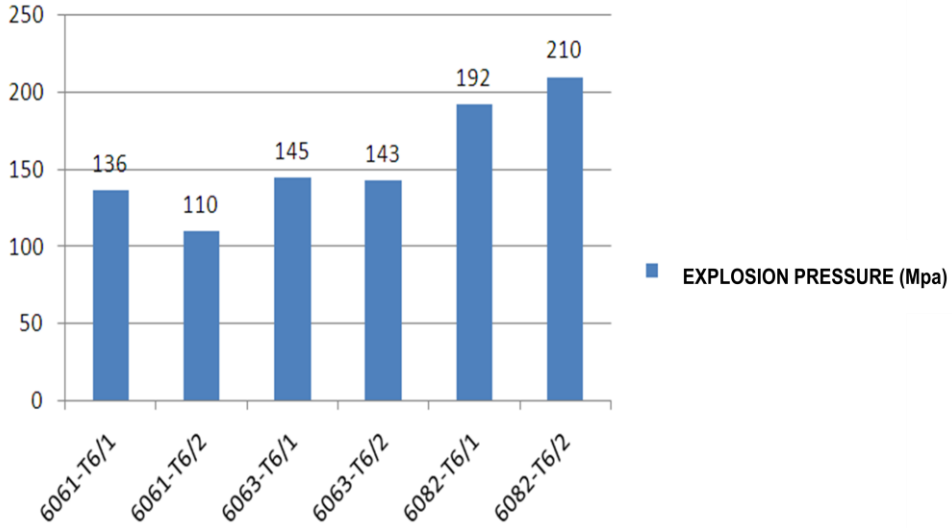


Figure 11. Hydrostatic Pressure Test Results

Heat Treatment State Chart and Explosion Pressure Graph of the hydrogen tube liner prototypes produced from 6000 Series aluminum alloy are shown in Figure 12;



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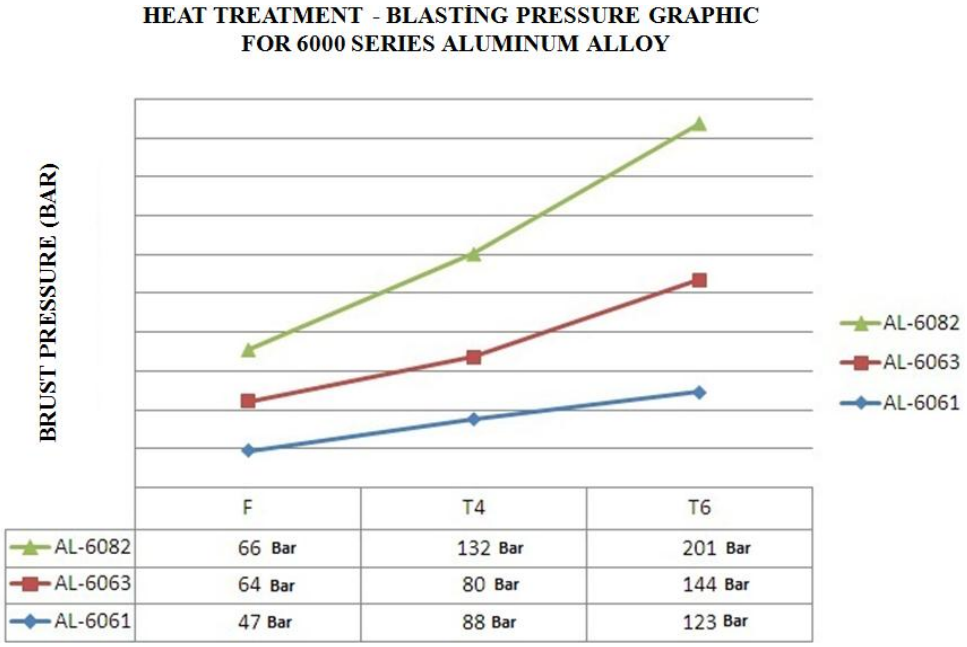


| | F | T4 | T6 |
|---|---|---|---|
| AL-6082 | 66 Bar | 132 Bar | 201 Bar |
| AL-6063 | 64 Bar | 80 Bar | 144 Bar |
| AL-6061 | 47 Bar | 88 Bar | 123 Bar |

Figure12. Heat Treatment - Blasting Pressure Graphic for 6000 Series Aluminum Alloy

**Explanations:**

F: Without heat treatment T4: T4 With heat treatment T6: T6 With heat treatment

**RESULTS**

Hydrostatic pressure test results are calculated by taking the avarages of the results performed for each sample for more than one time. Two pressure tests were carried out for each sample to get the right data. In both without heat treatment, T4 and T6 heat treatment 6082 aluminum alloy provided the best strength properties.

Even if the tubes which are manufactured under Santez can not find a chance to be used for hydrogen storage, will have the chance to be used for compressed natural gas (CNG) storage.

Composite tubes are safe. Can be mounted under the vehicle. Luggage storage volume will grow.

We should have a leading position in implementation of hydrogen technologies in many areas with using our country's manufacturing infrastructure and manpower advantages in the manufacturing and efficient use of tanks.

Testing standards in design of hybrid vehicles should be searched and approved by an authorized organization.

Majority of prototype hydrogen storage tanks are 350 bar pressure operating tanks. With recent studies, pressure values are doubled and more hydrogen can be stored in the same volume. The first time in our country, tubes with 700 bar working pressure are manufactured within the context of Santez-123 project, supported by the T.C. Ministry of Industry. Studies for the compliance with the standards and commercialization are currently being performed. When the other parallel studies are finished, costs of hydrogen energy equipment which is being imported will decrease and prototype manufacture will be accelerated in our country as well as in developed countries.

Since the costs of batteries and fuel tanks imported from abroad are expensive the initial investment where hydrogen technology will be used, is so high. Therefore we should start to produce regarding domestic equipment as soon as possible.

In this study it is found that the high-pressure resistant thin-walled aluminum alloy tubes' strength properties are limited to 20MPa.

All related tests and quality criteria of these tanks are given in TS EN 1975. (TS EN 1975).

## ACKNOWLEDGEMENTS

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# ENGINE ROOM SIMULATOR AND IMPORTANCE OF APPLIED MARITIME EDUCATION

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**Abstract:** Marine Engine Room Simulator involves simulation with the support of main engine and auxiliary systems in the engine room. The machines and systems that have been simulated are main engine, diesel generators, boiler, evaporators, heat exchangers, purifiers, steering gear, pumps, compressors, valves and any other related parts.
The operating condition of machines and systems in the simulation is exactly the same with the real ones. Therefore, with simulation method, seafarer candidates get knowledge and skills at management level.
With in different failure scenarios that may be seen in practice in machine and systems, main aims are to increase capabilities of the students through operating and managing, and to raise qualified seafarers who have teamwork skill and use technology.
The Engine Room Simulator is a full mission simulator designed to meet the training requirements of marine engineers and plant operators from basic to advanced level with special reference to the requirements of Standards of Training, Certification and Watchkeeping (STCW), International Safety Management (ISM) Code and International Maritime Organization (IMO) Model Course 2.07. (DNV, 2000)
In this study, importance of applied Engine Room Simulator education, purpose and capabilities of Engine Room Simulator and knowledge and skills of future seafarers who have teamwork skill and use technology are examined.

**Key Words:** Engine Room Simulator, Education, Technology

## INTRODUCTION

Ship's equipment improves from year to year, involving many advanced technologies.Engine Room Simulators have been developed to meet the demands of maritime training with technology, which is very effective for improving the engineers and officers' management experiences and operation skills in emergency situations. (Huayao, 2005).

International and national requirements for shipping safety are becoming more and more detailed. Safety at sea begins with comprehensive training. Approximately 80% of maritime accidents are the result of human error. Simulation training, in a controlled environment, gives marine engineers the opportunity to learn experiment and interact with a variety of realistic situations that would be dangerous or expensive to recreate in real life. Training with Marine Engine Room Simulator offers potential benefits:

- Increased Safety at Sea
- Experience in Operating Typical Marine Propulsion Plants
- Lower Running Costs
- Reduced Insurance Premiums
- Specialized Seafarer Training



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- Understand of STCW requirements
- Assessment of Competence for Recruitment and Evaluation Purposes

**Purpose of Engine Room Simulator**

Engine Room Simulators are designed for the education and training of marine engineers in the operation of the ship's engine room machinery and keeping watch in the engine control room of vessels with a high level of automation. Aims of Engine Room Simulator are shown in figure 1.

Marine engineers have for decades used Engine Room Simulators for training in the understanding of engine room systems. The engine room simulator is designed to simulate various types of machinery and equipment as used in the engine room of a ship using a diesel engine as propulsion system. A general view of Engine Room Simulator is shown in figure 2. (IMO, 1998)

The purpose of Engine Room Simulator is to prepare the trainee for engine room operation including:

- Basic engine room installation (compressed air system, fresh and sea water cooling system, lubricating, fuel oil system etc.)
- main engine and auxiliary equipment procedures
- propulsion system maneuvering (main engine – reduction gear – CPP)

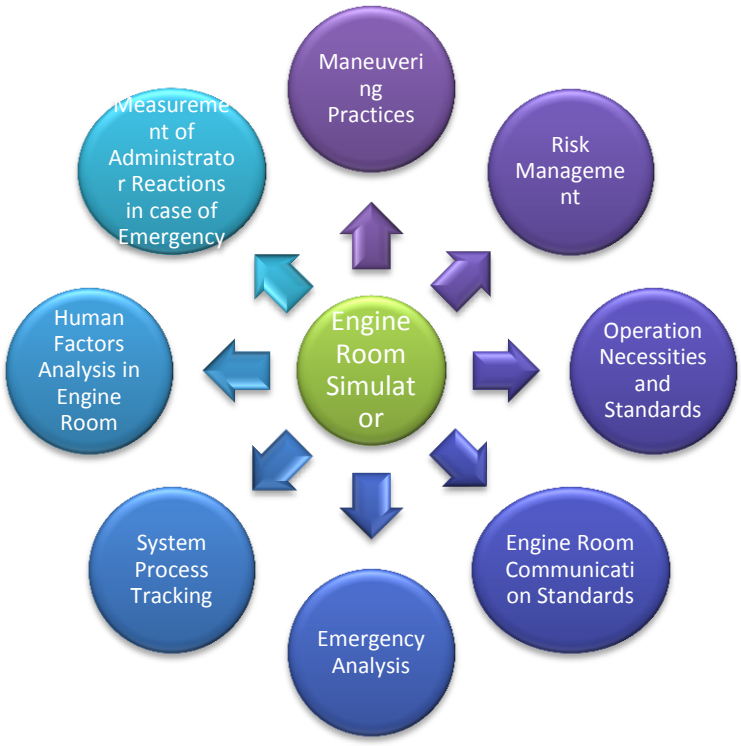


Fig. 1 Aims of Engine Room Simulator

The simulator must have developed in compliance with:

- STCW Code: Section A-1/12 and Section B-1/12. (STCW, 1996)



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- ISM Code: Section 6 and Section 8.

Fig. 2 General view of Engine Room Simulator (Kongsberg, 2008)

**Configuration of Engine Room Simulator**

Engine Room Simulator can be equipped with hardware consoles and panels to operate and control main engines, gear, CPP, auxiliary machinery and electric systems. There are three types of simulator configurations. These are:

1. Operational configurations
2. Workstation configurations
3. Combined operational and workstations configurations

The Engine Room Simulator can also be connected to a Ship's Bridge Simulator through a Local Area Network (LAN). (Kongsberg, 2008)

In figure 3 you can see an example of a combined engine room simulator system with detailed stations defined below.

A – Engine control room
B – Engine room
C – PC class room
D – Instructor's room

1. Engine control room hardware consoles
2. Electrical switchboard
3. Console in engine room
4. Speakers
5. Projectors with screens
6. Students' PC stations
7. Instructor's PC station

**Operational Configurations**



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The operational configurations consist of:

- Instructor Room
- Engine Control Room with main engine control console and main electric switchboard
- Engine Room

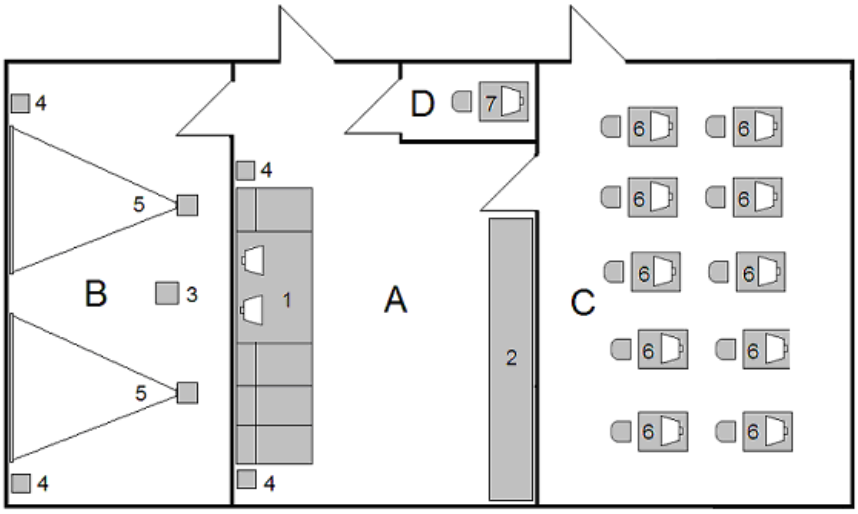


Fig. 3 An example of combined operational and workstations configurations

**Instructor Room**

The Instructor can configure the system to support individual student training and connect to any of the student stations to monitor, assess and control student performance. The instructor has the possibility to print out assessment reports for each individual student reflecting his performance, including pass or fail.

The instructor room can be configured to include one or more of the following separate units: (Kongsberg, 2008)

- Instructor station (PC station-console)
- Sound system
- Printer (event log)
- Hard copy printer
- Internet connection for remote diagnostic, SW updates and support
- Voice recorder system

The instructor's console has a panel for remote control of the main engine, a start switch for start-stop control of the simulator, an initial start condition setting panel for simulation start conditioning, and an abnormal condition setting panel for simulation condition changing. (Deniz, 2002)

**Engine Control Room**

The engine control room can be configured to include the following:

- Main Switchboard
- Engine Control Room Console
- Communication
- Alarm/Log Printer

**Main Switchboard**



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The main switchboard may consist of the following sections:

- Diesel generator sections
- Shaft generator section
- Turbo generator section
- Synchronizing section
- Starters section
- Feeders section
- Miscellaneous section

**Engine Control Room Console**

The Maine Engine Control Panel provides all controls and gauges for Maine Engine remote control. The engine control room console consists of the following sections:

- Generator/pump/compressor control section
- Monitoring/alarm and control section
- Main Engine remote control section

**SIMULATOR TRAINING**

The opportunities to experiment on specific problems and get answers on questions as: "what happens if....?" The best way to acquire practical experience is to learn from real life in a real engine room. Simulation can be an effective alternative to shipboard experience (Figure 4).

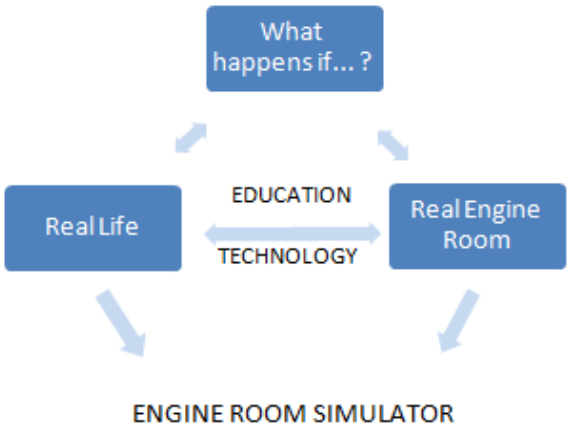


Fig. 4 Shipboard Experience

In maritime education practice, there is a good combination for seafarer candidates;

- Simulator
- Computer simulation
- Laboratory exercises.

An economical and safe operation of the ship is based on reliable equipment and skilled engineers taking correct decisions at the right time. The simulator training experience allows the mariner to go through



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understanding of plant operation and fault finding in a timely and effective manner. The simulator allows us to work in real time or whatever speed meets our training requirement. It also allows for creating just about any engineering plant problem one could come across at sea. As we all know, one problem with the plant normally leads to others, until the lights go out. The simulator can demonstrate all scenarios (Figure 5).

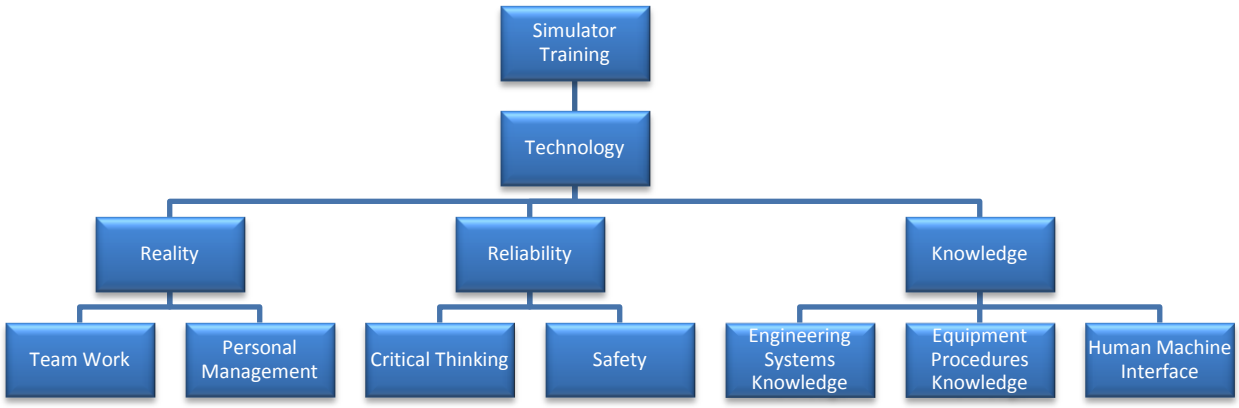


Fig. 5 Simulator Training

## CONCLUSION

The application of engine room simulators in maritime education leads to a better understanding of the marine engineering systems, equipment procedures and results also in increased safety and reduces the risk of human error in the operation and maintenance of marine equipment.
Safety reduces the risk of injuries to personnel and minimizes the risk of damage to the environment and engineering systems. A well run engine room managed by competent people improves economy. Onboard training using real equipment presents a number of challenges. Simulator training will reduce accidents and improve efficiency (risk assessment) and give the engineers the necessary experience and confidence in their job-situation. Increased risk to personnel and equipment combined with limited access to required marine assets and related escalating costs are creating increased demand for simulation technology.

To summarize, the application of engine room simulators will help to accelerate the understanding of marine engines, engine room, and auxiliary systems ... through an interactive learning process. It is not always possible to note the effects of damage on a part of the vessel's systems in the normal work condition. This is the reason of simulating certain damages effects by computers and by means of a simulator.

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# PHENOLIC COMPOUNDS OF ARGAN TREE, *ARGANIA SPINOSA* (ENDEMIC SPECIES OF SOUTH WESTERN MOROCCO)

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**Abstract:** *Argania spinosa* (L.) Skeels (Sapotaceae) is an endemic tree located mainly in south-western of Morocco. The argan tree plays medicinal, ecological and socioeconomic roles in this area. The fruit of A. spinosa has oil-producing kernels with a high unsaturated fatty acid content. The argan oil is greatly used in food and cosmetic products. Kernel, pulp of fruit and trunk have also been studied for sterols, triterpenes and saponins. Our goal in this study is to investigate the leaves for phenolic compounds by HPLC in 90 specimens of argan tree from three localities in Souss Massa area (south-western Morocco). Quantification and histolocalisation of phenolic components, i. e. flavonoids and condensed tannins (molecules well known for their broad spectrum of biological activities) in the three localities were carried out using chromatographic and spectroscopic methods combined to histochemical technics. Flavonol glycosides were quantified by HPLC from argan leaves. The main flavonol glycoside was myricitrin. The content of myricetin derivatives was higher than the quercetin derivative content. With regard to chemotaxonomy, four flavonol glycosides seem to be good markers for this species as they were detected by HPLC in 90 specimens of argan tree from the 3 localities. The histochemical studies of the different parts of A. spinosa (leaves, stems and thorns) have shown a high concentration of myricetin derivatives in the peripheral tissues, this cell localisation of the flavonoids could explain the Argan tree adaptation to aridity.

Key words**: *Argania spinosa* - Flavonol glycosides – Condensed tannins – Histochemistry.**

## INTRODUCTION

*Argania spinosa* (L.) Skeels (*Sapotaceae*) is an endemic and medicinal tree (Bellakhdar J., 1997) located mainly in south-western Morocco. The argan tree plays ecological and socioeconomic roles in this area (Boukhobza and Pichon-Prum, 1988).

The fruit of *A. spinosa* has oil-producing kernels with a high unsaturated fatty acid content (Maurin *et al*., 1992). The argan oil is greatly used in food (Huyghebaert and Hendrickx, 1974) and cosmetic products (Pierre Fabre Patent). Whereas kernel, pulp of fruit and trunk have been studied extensively for sterols, triterpenes and saponins (Farines *et al*., 1984; Charrouf *et al*., 1991, 1992; Maurin, 1992; Nerd *et al*., 1994; Oulad-Ali *et al*., 1996), relatively little is known about chemistry and histochemistry of the leaves, the stems and the thorns (Tahrouch *et al*., 1998 ; Tahrouch *et al*., 2000).

In order to understand both vigour and resistance of this endemic plant to an arid habitat, the leaves were investigated for phenolic compounds by HPLC in 90 specimens of argan tree from three localities. Quantification of phenolic components, i. e. flavonoids and condensed tannins in three localities were carried out using chromatographic and spectroscopic methods combined to histochemical techniques.



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## MATERIAL AND METHODS

The leaves of *Argania spinosa* were collected in the Ademine reserve (**A**) 60 m, Ait Baha (**AB**) 500 m and Immouzzer (**I**) 900 m, Agadir (Morocco). Voucher specimens were deposited in the Herbarium of Laboratoire des Symbiotes Racinaires et de Biochimie Végétale in Agadir. Dry leaves were extracted three times with MeOH/$H_2O$ (4/1) at room temperature.

### Histochemistry

Sections of leaves (45-60 µm thickness) were cut with a cryostat microtome (Frigocut 2800 E) operating at -20°C and examined using either a light microscope or an epi-fluorescence microscope (Nikon Optiphot) with two filter sets: UV filter set with 365 nm excitation and a 400 nm barrier filter. Flavonoid compounds were detected using Neu's reagent (Neu, 1956). Sections were immersed into the reagent for 1 min and then observed by epi-fluorescence (Dai *et al*., 1995). DMCA (4-dimethylaminocinnamaldehyde) reagent was used to locate condensed tannins (Feucht *et al*., 1986). Stained sections were observed with a light microscope.

**Quantification of flavonoids and condensed tannins**

HPLC was carried out using an isocratic mobile phase (Acetonitrile/MeOH/$H_2O$, 2/8/15) running through Nucleosil C18 (250 x 4 mm, 5 µm particle size). UV-Visible data were recorded using a Photodiode Array Detector coupled to HPLC system. Flavonoids of argan leaves were quantified using myricitrin as internal standard at 350 nm.

Quantitative determination of condensed tannins were carried out by UV and visible spectrophotometry according to Mc Murrough and Mc Dowell (1978).

## RESULTS

*A. spinosa* was investigated for condensed tannins and flavonoids, molecules well known for their broad spectrum of biological activities, (Di Carlo *et al*., 1999). Flavonol glycosides were quantified by HPLC from argan leaves (figure 1). The main flavonol glycoside (Tahrouch *et al*., 2000) was myricitrin [**2**]. The content of myricetin derivatives [**2**, **4**] was higher (≅ 20 $mg.g^{-1}$ D. W.) than the quercetin derivative [**1**, **3**] content (≅ 8 $mg.g^{-1}$ D. W.).

| Compounds | Quercitrin [**1**] | Myricitrin [**2**] | Hyperoside [**3**] | Myricetin-3-O-galactoside [**4**] |
|---|---|---|---|---|
| Rt[a] | 15.2 | 8.8 | 10.1 | 6.8 |
| Q[b] | 5.3±0.4 | 16.8±1.4 | 2.5±0.2 | 3.3±0.3 |

[a] retention time (minutes) ; [b] quantity ($mg.g^{-1}$ D. W. ± s.e.)

With regard to chemotaxonomy, these four molecules seem to be good markers for this species as they were detected by HPLC in 90 specimens of argan tree from the 3 localities : A, AB and I (tables 1, 2 and 3).

These results showed that there is a close relationship between A and AB. The amount of flavonoids in these 2 localities (A and AB) is higher than in I. A and AB are located in arid areas.

It might be advisable to combine analytical and histological methods. With histochemistry we are able to localise *in situ* the flavonoids by Neu's reagent, which give a bright orange-yellow fluorescence



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under UV. Neu's reagent is a borate salt that forms complex with certain groups of phenolic compounds giving them specific fluorescence (doc. 1). Condensed tannins detected histochemically by using DMCA reagent give a blue coloration under white light (doc. 2).

The histochemical studies of the different parts of *A. spinosa* (leaves, stems and thorns) have shown a high concentration of myricetin derivatives in the peripheral tissues particularly in epidermis while condensed tannins were mainly deposited in the cortex and palisade mesophyl.

The high content of total flavonoids in specimens of *A. spinosa* that located in localities A and AB, could play a protective role in the expression of tolerance to UV-radiations as showed by Lois (1994) in *Arabidopsis thaliana* (*Brassicaceae*). Olsson *et al.* (1998) explained that flavonoids afforded a protective role not only through the absorption of UV-radiations, especially in the epidermal layers, but also through a selective increase after UV-B irradiation that happens for flavonoids which possess an additional hydroxyl group in the B-ring of the flavonoid skeleton such as quercetin and myricetin derivatives that we identified from *A. spinosa* leaves.

The increase of phenolic compound biosynthesis in plant under UV-radiation and during periods of water stress and nutrient deficiency (Keller and Hrazdina, 1998) might be an adaptation phenomena (Gershenzon, 1984). Indeed, the biosynthesis of flavonoids in plants is enhanced in response to changes in the external environment (Cooper-Driver and Bhattacharya, 1998). According to this hypothesis, plants that normally occupy arid area and infertile habitats, such as argan trees, could have continuously high levels of phenolic constituents. The high amount of phenolic components and their localisation in the peripheral tissues might contribute to understand the relationship between accumulation of polyphenols and adaptation of argan tree to his area.

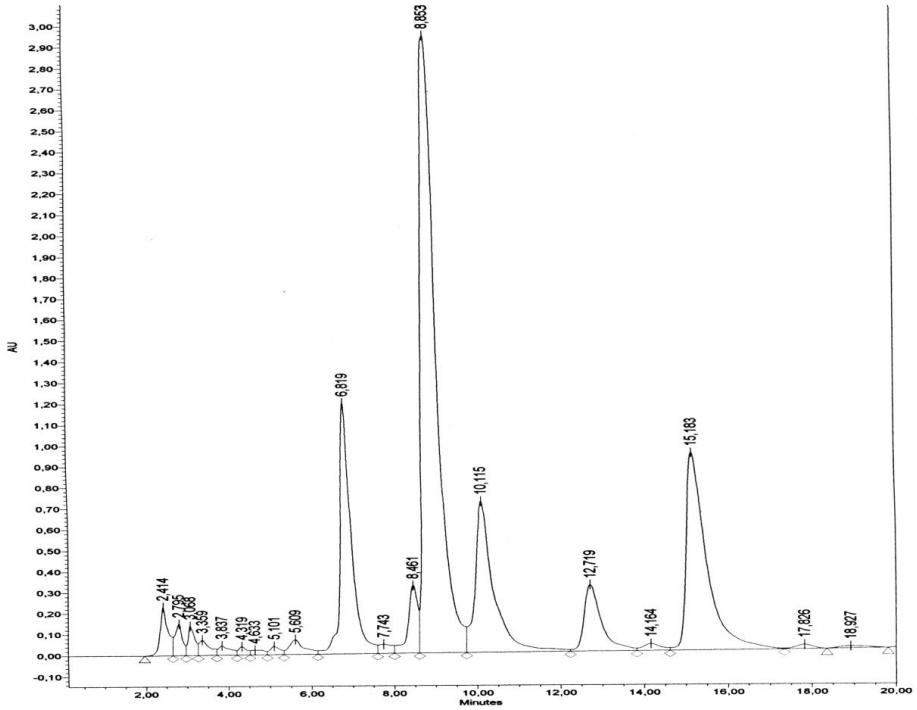


Figure 1 : HPLC of methanolic extract of Argan leaves.

| components | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 | M10 |
|---|---|---|---|---|---|---|---|---|---|---|
| retention time | 2,41 | 2,80 | 5,60 | 6,81 | 8,46 | 8,85 | 10,11 | 12,71 | 14,16 | 15,18 |



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M4 : Myricetin 3-O-galactoside (**D**)
M6 : Myricitrin (**B**)
M7 : Hypéroside (**C**)
M10 : Quercitrin (**A**)
M5 : Myricetin derivatives
M8 : Quercetin derivatives
**The other flavonoids (M1, M2, M3, and M9) were not identified.**

Table 1 : Quantification of flavonoids (M1-M10) and condensed tannins (M11) in Admine reserve ($mg.g^{-1}$ D.W.).

| | M1 | M2 | M3 | M4 (D) | M5 | M6 (B) | M7 (C) | M8 | M9 | M10 (A) | M11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,460 | 1,426 | 0 | 2,740 | 0 | 10,037 | 2,318 | 1,517 | 1,134 | 2,214 | 59,90 |
| 2 | 1,623 | 1,800 | 1,055 | 2,081 | 1,143 | 15,484 | 1,054 | 1,118 | 1,729 | 5,892 | 44,00 |
| 3 | 1,327 | 1,545 | 1,093 | 1,875 | 0 | 8,670 | 2,368 | 1,438 | 1,503 | 4,674 | 139,35 |
| 4 | 1,536 | 1,330 | 0 | 0 | 0 | 7,190 | 0 | 0 | 0 | 1,698 | 47,35 |
| 5 | 1,504 | 1,368 | 1,089 | 2,646 | 1,062 | 9,635 | 1,945 | 1,404 | 1,182 | 2,454 | 78,75 |
| 6 | 1,248 | 1,219 | 1,169 | 3,488 | 0 | 15,129 | 2,330 | 1,187 | 1,566 | 4,734 | 69,55 |
| 7 | 1,288 | 1,281 | 0 | 1,608 | 0 | 10,392 | 0 | 1,042 | 1,244 | 3,162 | 81,30 |
| 8 | 1,334 | 1,341 | 1,096 | 4,330 | 0 | 12,842 | 3,184 | 1,804 | 1,252 | 3,115 | 72,90 |
| 9 | 1,228 | 1,266 | 0 | 1,643 | 0 | 6,312 | 0 | 1,040 | 1,066 | 1,955 | 60,35 |
| 10 | 1,447 | 1,724 | 0 | 2,231 | 0 | 12,562 | 2,499 | 1,305 | 1,354 | 3,924 | 60,35 |
| 11 | 1,338 | 1,547 | 1,085 | 2,607 | 1,147 | 18,753 | 1,039 | 1,205 | 1,596 | 5,219 | 90,55 |
| 12 | 1,356 | 1,526 | 1,163 | 2,763 | 1,340 | 14,220 | 3,522 | 1,539 | 1,608 | 5,494 | 68,30 |
| 13 | 1,486 | 1,592 | 1,224 | 3,098 | 1,305 | 19,165 | 2,678 | 1,375 | 1,901 | 7,860 | 144,30 |
| 14 | 1,256 | 1,345 | 1,142 | 2,443 | 1,063 | 9,150 | 2,742 | 1,649 | 1,467 | 4,131 | 32,70 |
| 15 | 1,768 | 1,833 | 0 | 4,107 | 0 | 28,365 | 4,159 | 1,429 | 2,819 | 14,381 | 91,55 |
| 16 | 1,285 | 1,349 | 0 | 2,891 | 1,097 | 11,639 | 2,739 | 1,559 | 1,664 | 5,669 | 52,40 |
| 17 | 1,594 | 1,666 | 1,468 | 5,402 | 0 | 21,789 | 3,439 | 1,632 | 1,318 | 3,686 | 103,50 |
| 18 | 1,267 | 1,378 | 1,038 | 2,858 | 0 | 14,132 | 2,421 | 1,451 | 1,323 | 3,318 | 65,80 |
| 19 | 1,547 | 1,662 | 1,414 | 4,776 | 1,327 | 26,907 | 1,067 | 1,587 | 1,522 | 4,724 | 63,70 |
| 20 | 1,546 | 1,513 | 1,135 | 4,204 | 1,202 | 21,866 | 2,999 | 1,300 | 1,734 | 5,550 | 69,60 |
| 21 | 1,115 | 1,196 | 0 | 1,579 | 0 | 8,061 | 0 | 1,080 | 1,156 | 2,398 | 45,40 |
| 22 | 1,580 | 1,698 | 1,090 | 2,947 | 1,079 | 16,483 | 3,196 | 1,464 | 1,956 | 7,040 | 78,10 |
| 23 | 1,534 | 1,564 | 1,196 | 4,648 | 1,246 | 27,859 | 3,920 | 1,695 | 2,894 | 11,972 | 87,85 |
| 24 | 1,158 | 1,269 | 1,050 | 2,627 | 0 | 11,538 | 2,051 | 1,218 | 1,309 | 3,347 | 111,10 |
| 25 | 1,196 | 1,383 | 1,317 | 2,096 | 0 | 12,266 | 2,410 | 1,201 | 1,646 | 5,044 | 102,00 |
| 26 | 1,311 | 1,396 | 1,270 | 3,391 | 0 | 20,390 | 0 | 1,235 | 1,574 | 4,705 | 39,90 |
| 27 | 1,617 | 1,570 | 1,465 | 2,337 | 1,208 | 15,267 | 2,446 | 1,438 | 1,851 | 6,541 | 61,15 |
| 28 | 1,325 | 1,450 | 1,354 | 2,286 | 1,040 | 10,558 | 2,804 | 1,636 | 1,446 | 4,291 | 61,55 |
| 29 | 1,498 | 1,466 | 1,434 | 3,618 | 1,113 | 18,156 | 2,744 | 1,502 | 1,522 | 4,914 | 72,60 |
| 30 | 1,557 | 1,534 | 1,302 | 2,676 | 1,091 | 17,152 | 2,577 | 1,430 | 1,608 | 5,267 | 70,05 |

Table 2 : Quantification of flavonoids (M1-M10) and condensed tannins (M11) in Aït Baha reserve ($mg.g^{-1}$ D.W.).

| | M1 | M2 | M3 | M4 (D) | M5 | M6 (B) | M7 (C) | M8 | M9 | M10 (A) | M11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,459 | 1,4264 | 0 | 2,740 | 0 | 10,036 | 2,317 | 1,516 | 1,133 | 2,2136 | 60,70 |
| 2 | 1,622 | 1,7996 | 1,054 | 2,080 | 1,143 | 15,483 | 1,054 | 1,117 | 1,729 | 5,8924 | 62,00 |
| 3 | 1,326 | 1,5452 | 1,092 | 1,874 | 0 | 8,669 | 2,367 | 1,437 | 1,502 | 4,674 | 50,95 |
| 4 | 1,536 | 1,33 | 0 | 0 | 0 | 7,190 | 0 | 0 | 0 | 1,6976 | 58,15 |
| 5 | 1,504 | 1,3684 | 1,088 | 2,646 | 1,062 | 9,635 | 1,945 | 1,404 | 1,182 | 2,4536 | 99,00 |
| 6 | 1,248 | 1,2192 | 1,169 | 3,487 | 0 | 15,129 | 2,330 | 1,187 | 1,565 | 4,7344 | 70,90 |
| 7 | 1,287 | 1,2812 | 0 | 1,608 | 0 | 10,392 | 0 | 1,042 | 1,244 | 3,162 | 50,10 |
| 8 | 1,334 | 1,3412 | 1,095 | 4,330 | 0 | 12,842 | 3,184 | 1,804 | 1,251 | 3,1148 | 53,50 |
| 9 | 1,227 | 1,2656 | 0 | 1,642 | 0 | 6,311 | 0 | 1,039 | 1,064 | 1,9548 | 51,80 |
| 10 | 1,447 | 1,7244 | 0 | 2,230 | 0 | 12,562 | 2,499 | 1,304 | 1,353 | 3,924 | 112,2 |
| 11 | 1,338 | 1,5472 | 1,085 | 2,607 | 1,146 | 18,753 | 1,038 | 1,205 | 1,595 | 5,2192 | 49,65 |
| 12 | 1,356 | 1,5256 | 1,163 | 2,763 | 1,340 | 14,219 | 3,522 | 1,539 | 1,608 | 5,494 | 72,15 |
| 13 | 1,485 | 1,592 | 1,223 | 3,098 | 1,305 | 19,165 | 2,678 | 1,374 | 1,901 | 7,8596 | 72,15 |
| 14 | 1,256 | 1,3452 | 1,141 | 2,442 | 1,063 | 9,1504 | 2,741 | 1,649 | 1,466 | 4,1308 | 60,30 |
| 15 | 1,768 | 1,8328 | 0 | 4,107 | 0 | 28,364 | 4,158 | 1,429 | 2,819 | 14,3808 | 130,30 |
| 16 | 1,284 | 1,3492 | 0 | 2,890 | 1,096 | 11,639 | 2,738 | 1,559 | 1,663 | 5,6692 | 43,30 |
| 17 | 1,594 | 1,666 | 1,467 | 5,401 | 0 | 21,789 | 3,438 | 1,632 | 1,318 | 3,6856 | 81,50 |
| 18 | 1,267 | 1,378 | 1,038 | 2,858 | 0 | 14,132 | 2,421 | 1,450 | 1,322 | 3,318 | 47,10 |
| 19 | 1,546 | 1,6624 | 1,414 | 4,775 | 1,327 | 26,906 | 1,067 | 1,586 | 1,522 | 4,724 | 59,45 |
| 20 | 1,546 | 1,5128 | 1,134 | 4,204 | 1,202 | 21,865 | 2,999 | 1,300 | 1,733 | 5,55 | 64,10 |
| 21 | 1,115 | 1,196 | 0 | 1,578 | 0 | 8,061 | 0 | 1,080 | 1,156 | 2,3976 | 31,40 |
| 22 | 1,580 | 1,6984 | 1,090 | 2,947 | 1,078 | 16,482 | 3,195 | 1,464 | 1,955 | 7,04 | 70,05 |
| 23 | 1,534 | 1,5644 | 1,196 | 4,647 | 1,246 | 27,858 | 3,920 | 1,695 | 2,894 | 11,9716 | 44,55 |
| 24 | 1,158 | 1,2688 | 1,049 | 2,626 | 0 | 11,538 | 2,050 | 1,218 | 1,309 | 3,3468 | 30,55 |
| 25 | 1,196 | 1,3828 | 1,316 | 2,096 | 0 | 12,266 | 2,409 | 1,201 | 1,646 | 5,0444 | 37,80 |
| 26 | 1,310 | 1,3964 | 1,269 | 3,391 | 0 | 20,390 | 0 | 1,234 | 1,574 | 4,7048 | 58,15 |
| 27 | 1,616 | 1,57 | 1,464 | 2,337 | 1,208 | 15,267 | 2,446 | 1,438 | 1,850 | 6,5408 | 64,95 |
| 28 | 1,325 | 1,45 | 1,354 | 2,285 | 1,040 | 10,558 | 2,803 | 1,636 | 1,446 | 4,2912 | 57,30 |
| 29 | 1,498 | 1,4656 | 1,434 | 3,617 | 1,112 | 18,156 | 2,744 | 1,501 | 1,522 | 4,9144 | 61,95 |
| 30 | 1,557 | 1,534 | 1,302 | 2,676 | 1,090 | 17,152 | 2,576 | 1,429 | 1,607 | 5,2672 | 103,00 |



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Table 3 : Quantification of flavonoids (M1-M10) and condensed tannins (M11) in Immouzer reserve (mg.g$^{-1}$ D.W.).

| | M1 | M2 | M3 | M4 (D) | M5 | M6 (B) | M7 (C) | M8 | M9 | M10 (A) | M11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1,270 | 0 | 4,234 | 1,834 | 1,205 | 1,248 | 2,682 | 9,80 |
| 2 | 0 | 0 | 0 | 0 | 0 | 5,142 | 1,340 | 0 | 1,153 | 2,208 | 17,95 |
| 3 | 0 | 0 | 0 | 1,326 | 0 | 6,211 | 1,960 | 1,334 | 1,227 | 2,862 | 20,40 |
| 4 | 0 | 0 | 0 | 0 | 0 | 1,865 | 0 | 1,247 | 0 | 0 | 8,63 |
| 5 | 0 | 0 | 0 | 1,600 | 0 | 3,102 | 1,812 | 1,145 | 0 | 1,588 | 14,70 |
| 6 | 0 | 0 | 1,225 | 2,238 | 0 | 6,707 | 2,258 | 1,401 | 1,186 | 2,478 | 26,30 |
| 7 | 0 | 0 | 0 | 2,107 | 0 | 7,148 | 3,265 | 1,446 | 1,531 | 4,302 | 26,50 |
| 8 | 1,073 | 0 | 0 | 2,019 | 0 | 8,776 | 2,946 | 1,662 | 1,493 | 4,170 | 28,55 |
| 9 | 0 | 0 | 1,200 | 1,078 | 0 | 2,554 | 1,399 | 1,120 | 1,114 | 2,080 | 19,60 |
| 10 | 1,064 | 1,130 | 0 | 2,096 | 0 | 8,979 | 2,496 | 1,505 | 1,333 | 3,231 | 33,85 |
| 11 | 1,130 | 1,150 | 1,836 | 3,552 | 0 | 15,080 | 5,596 | 2,871 | 2,285 | 7,092 | 55,25 |
| 12 | 0 | 1,096 | 0 | 1,716 | 0 | 7,125 | 1,966 | 1,273 | 1,259 | 2,859 | 29,60 |
| 13 | 0 | 0 | 0 | 3,013 | 0 | 9,233 | 2,688 | 1,714 | 1,311 | 2,642 | 47,75 |
| 14 | 0 | 1,138 | 0 | 1,930 | 0 | 6,905 | 2,670 | 1,352 | 1,442 | 3,643 | 26,50 |
| 15 | 1,458 | 1,470 | 1,434 | 3,086 | 0 | 17,116 | 4,060 | 2,266 | 2,401 | 6,754 | 64,10 |
| 16 | 1,097 | 1,042 | 1,836 | 2,861 | 0 | 6,348 | 2,474 | 1,867 | 1,289 | 2,756 | 30,20 |
| 17 | 1,150 | 1,096 | 0 | 1,609 | 0 | 6,210 | 1,888 | 1,284 | 1,502 | 4,257 | 39,80 |
| 18 | 0 | 1,050 | 0 | 2,746 | 0 | 10,995 | 3,082 | 1,556 | 1,994 | 7,053 | 31,60 |
| 19 | 1,440 | 1,377 | 0 | 1,466 | 0 | 7,841 | 1,881 | 1,291 | 1,442 | 3,740 | 97,55 |
| 20 | 1,260 | 1,362 | 0 | 3,098 | 0 | 11,747 | 4,166 | 1,962 | 1,875 | 5,566 | 49,45 |
| 21 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 12,65 |
| 22 | 1,232 | 1,476 | 0 | 5,232 | 0 | 13,406 | 5,368 | 2,608 | 1,992 | 5,956 | 55,25 |
| 23 | 1,207 | 1,255 | 0 | 1,328 | 0 | 3,524 | 1,517 | 1,150 | 1,086 | 1,962 | 54,45 |
| 24 | 1,059 | 0 | 1,045 | 3,211 | 0 | 10,314 | 3,852 | 1,904 | 1,740 | 5,054 | 36,85 |
| 25 | 1,170 | 1,246 | 0 | 2,663 | 0 | 7,971 | 3,128 | 1,739 | 1,529 | 4,084 | 51,10 |
| 26 | 1,247 | 1,344 | 1,495 | 2,847 | 0 | 10,469 | 3,654 | 1,967 | 1,856 | 5,230 | 45,25 |
| 27 | 0 | 0 | 0 | 1,900 | 0 | 6,533 | 2,755 | 1,489 | 1,520 | 3,834 | 19,60 |
| 28 | 1,503 | 1,462 | 0 | 2,370 | 0 | 17,876 | 3,230 | 1,742 | 2,158 | 6,254 | 59,10 |
| 29 | 1,041 | 1,141 | 0 | 0 | 0 | 3,987 | 0 | 0 | 1,302 | 2,928 | 38,10 |
| 30 | 0 | 1,127 | 0 | 2,153 | 0 | 6,617 | 2,544 | 1,458 | 1,242 | 2,586 | 27,75 |

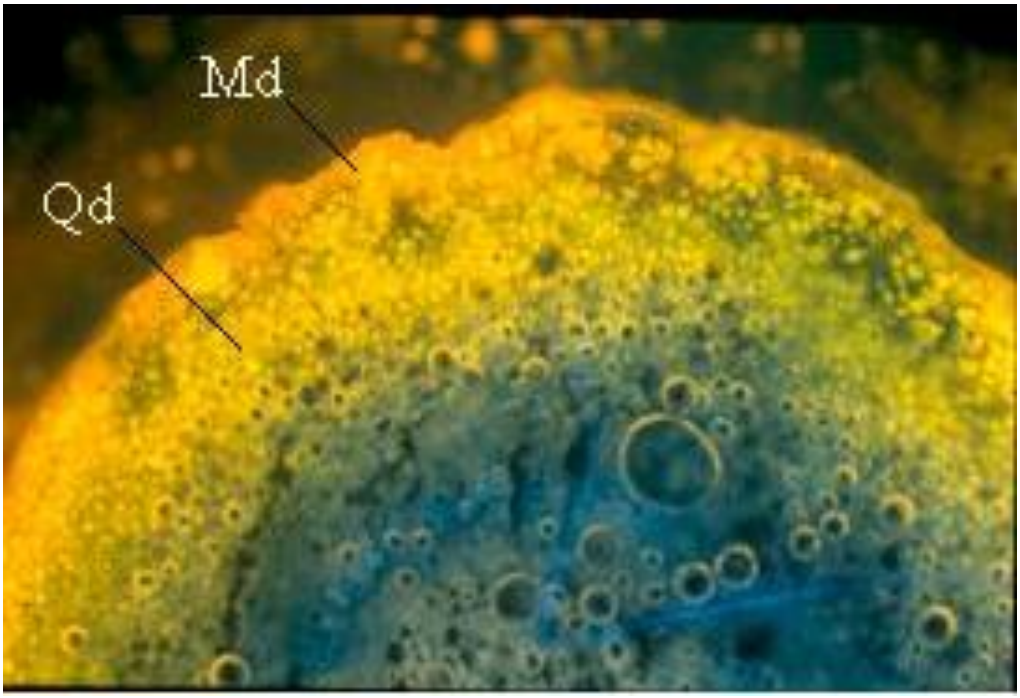


Figure 2 : The histochemical study from the stem of *A. spinosa* showed a high content of myricetin derivatives (Md) in the peripheral tissues. Qd : Quercetin derivatives.



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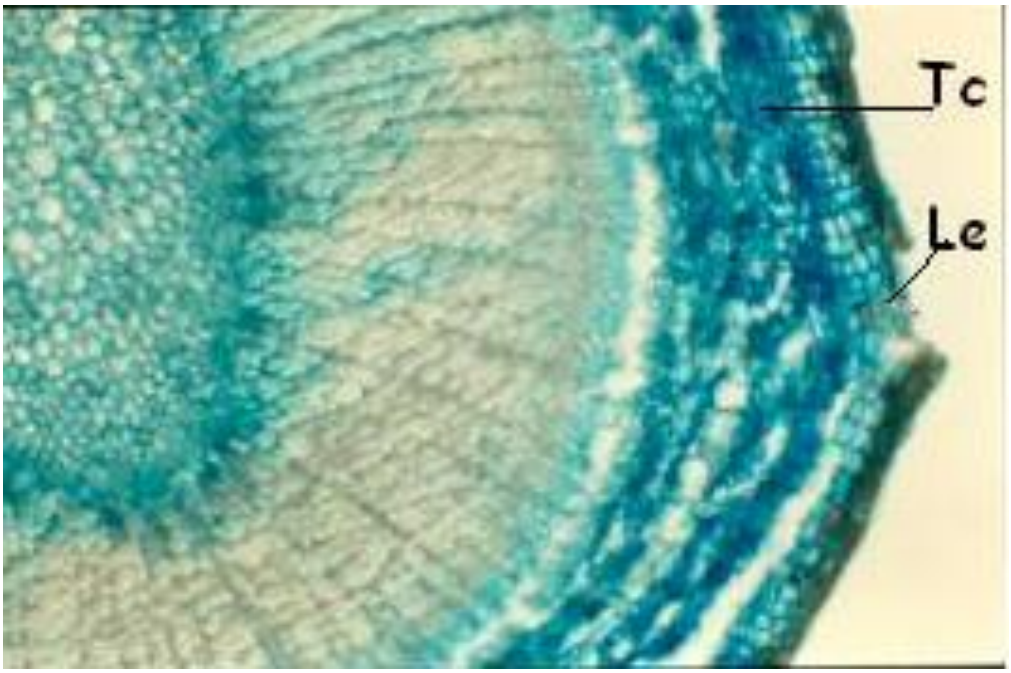


Figure 3 : The histochemical studie from the stem of *A. spinosa* showed a high concentration of condensed tannins (Tc) mainly deposited in the cortex. Le : lenticel.

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# WELDING TECHNOLOGIES IN SHIPBUILDING INDUSTRY

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**Abstract:** Welding is very important in shipbuilding industry. In order to protect the ship structure, this process should be performed by the qualified welders and controlled efficiently by the quality control engineers and Classification Societies. All welders should have a certificate and the procedures should be prepared in the shipyards.

There are several kinds of welding methods. In shipbuilding, the most common technique is electrical arc welding. With the developed technology in all areas, welding technology is improving with each passing day. Today, ceramic welding is much started to be used especially on the shell platings and block connections. This provides easiness for the welders and shortens the production period.

The shipyards that intend to construct bigger vessels, build up production lines and use robots for welding in these lines. This increases quality, production capacity and decreases the planning times and production periods.

In the scope of new technologies on welding, the importance of welding and the benefits of new techniques to the ship building are investigated, evaluated and some suggestions are put forward.

**Key words:** Welding, Shipbuilding, Technology, Ships

## INTRODUCTION

Welding is defined as "a jumping process that produces coalescence of materials by heating them to the welding temperature, with or without the application of pressure alone, and with or without the use of filler metal. In less technical language, a weld is made when separate pieces of material to be joined combine and form one piece when heated to a temperature high enough to cause softening or melting and flow together. Filler material is added when needed to form a completed weld in the joint.

Modern welding techniques are employed in the construction of numerous products. Ships, buildings, bridges are fabricated by welding processes. Welding is also used extensively in the manufacture of automobiles, farm equipment, home appliances, computer components, mining equipment and earth moving. Hundreds of products we use in our daily life are also joined together by some type of welding processes.

Before welding, ships were being constructed by using clinches. Nowadays, due to welding is more water resistant comparing to clinch system, ships are being constructed by welding. There are several types of welding processes grown in recent years. These processes differ greatly in the manner in which heat, pressure, or both heat and pressure are applied and in the type of equipment used.

## TYPES OF WELDING USED IN SHIPBUILDING INDUSTRY

The most popular welding processes in shipbuilding industry are



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- Shielded metal arc welding (SMAW), often called stick welding
- Submerged Arc Welding
- Gas metal arc welding (GMAW)
- Gas tungsten arc welding (GTAW)
- Oxyacetylene Welding (OAW)

**Shielded Metal Arc Welding (SMAW)**

This method is also known as Manual Metal Arc Welding or Stick Welding. An arc welding process in which coalescence of metals is produced by heat. The heat comes from an electric arc that is maintained between the tip of a covered electrode and the surface of the base metal in the joint being welded.
In the SMAW process, welding is done by setting up an electrical circuit using a welding machine to produce the electricity, a welding cable with an electrode holder to hold the electrode and a ground cable with a clamp to fasten to the work-piece to complete the circuit. The weld is made by touching the electrode to the work-piece closing the electrical circuit and causing the electrode to melt and form the weld.
The consumable electrode provides:
1) Gas protection to shield the arc and prevent atmospheric contamination of the molten filler metal.
2) Adding elements to change the mechanical properties and prevents excessive grain growth in the welded metal.
3) Enhance the mechanical properties and surface cleanliness of the weld metal.

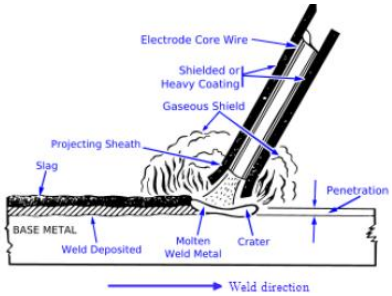

Fig. 1: Shielded Metal Arc Welding

This welding method is used for maintenance and repair industries, naval industry, pipelines, offshore platforms, construction of steel structures, weld carbon steel, low and high alloy steel, stainless steels, cast iron, aluminum, nickel and cooper alloys.

The advantages of this method are as follows;

- High quality welds can be made rapidly and with excellent uniformity.
- A variety of metal types and metal thicknesses can be joined with one machine.
- The equipment is cheap, versatile, simple and portable and welds can be done in any position.
- Suitable for out-of-position welding
- Adaptable to confined spaces and remote locations

The disadvantages of this method are as follows;

- Smokes prejudicial to health;
- Electrode type choice is crucial;
- Hydroscopic electrodes;
- Need to remove slag immediately due inclusions problems;
- Quality depends welder skill.

**Submerged Arc Welding**



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Submerged arc welding is a method in which the heat required to fuse the metal is generated by an arc formed by an electric current passing between the welding wire and the workpiece. The tip of the welding wire, the arc, and the workpiece are covered by a layer of granulated mineral material known as submerged arc welding flux. There is no visible arc and no sparks, spatter or smoke.
An arc is maintained between the end of a bare wire electrode and the work. As the electrode is melted, it is fed into the arc by a set of rolls, driven by a governed motor. Wire feed speed is automatically controlled to equal the rate at which the electrode is melted, thus arc length is constant (similar to MIG/MAG - constant voltage). The arc operates under a layer of granular flux, hence submerged arc. Some of the flux melts to provide a protective blanket over the weld pool. The remainder of the flux is unaffected and can be recovered and re-used, provided it is dry and not contaminated. A semi-automatic version is available in which the operator has control of a welding gun that carries a small quantity of flux in a hopper.

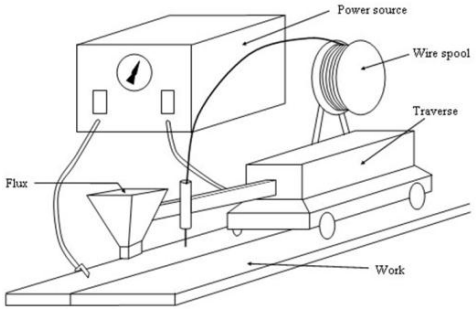

Fig. 2: Submerged Arc Welding

The advantages of this method are as follows;

- Lends itself to the production of consistently high quality welds with minimum operator skills.
- Minimum of welding fume and of arc visibility (radiation).
- Well suited to welding thick sections.
- Suitable for welding carbon, low alloy and alloy steels.
- Relatively high metal deposition rates

The disadvantages of this method are as follows;

- Flat or horizontal position welding only
- Care required to preserve correct electrode alignment, as electrode
- Tip and weld pool are underneath solid flux cover

This welding method is mainly used for welding of thick steel plates in heavy industry such as shipbuilding, large diameter pipes manufacturing, boilers manufacturing.

**Gas Metal Arc Welding (GMAW)**

Gas Metal Arc Welding (GMAW), by definition, is an arc welding process which produces the coalescence of metals by heating them with an arc between a continuously fed filler metal electrode and the work. The process uses shielding from an externally supplied gas to protect the molten weld pool.
Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. Nowadays,with the development of electronic controlled welding machines, the process of welding cause has become very common.

GMAW can be done in three different ways:

- Semiautomatic Welding:Equipment controls only the electrode wire feeding. Movement of welding gun is controlled
  by hand. This may be called hand-held welding.
- Machine Welding: This method uses a gun that is connected to a manipulator of some kind (not hand-held). An operator has to constantly set and adjust controls that move the manipulator.
- Automatic Welding: This method uses equipment which welds without the constant adjusting of controls by a welder or operator.



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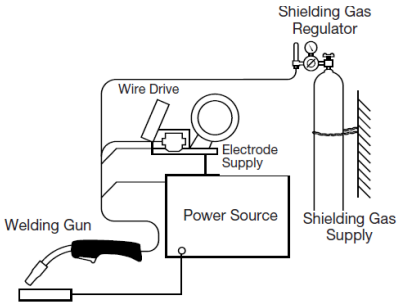


Fig. 3: Gas Metal Arc Welding

The advantages of GMAW are as follows;

- Welding can be done in all positions.
- No slag removal required.
- High weld metal deposition rate.
- Overall times for weld completion about 1/2 that of covered electrode.
- High welding speeds. Less distortion of the workpiece.
- High weld quality.
- Large gaps filled or bridged easily, making certain kinds of repair welding more efficient.
- No stub loss as with covered electrode

The disadvantages of GMAW are as follows;

- Expensive and complex equipment
- Setting up equipment can be time consuming and trick.

**Gas tungsten arc welding (GTAW)**

Gas Tungsten Arc Welding (GTAW), also known as tungsten inert gas (TIG) welding is a process that produces an electric arc maintained between a nonconsumable tungsten electrode and the part to be welded. The heat-affected zone, the molten metal and the tungsten electrode are all shielded from atmospheric contamination by a blanket of inert gas fed through the GTAW torch. Inert gas (usually Argon) is inactive or deficient in active chemical properties.

The shielding gas serves to blanket the weld and exclude the active properties in the surrounding air. Inert gases such as Argon and Helium do not chemically react or combine with other gases. They pose no odor and are transparent, permitting the the welder maximum visibility of the arc. In some instances Hydrogen gas may be added to enhance travel speeds.

GTAW is used to weld stainless steel, nickel alloys such as MonelR and InconelR, titanium, aluminum, magnesium, copper, brass, bronze and even gold. GTAW can also weld dissimilar metals to one another such as copper to brass and stainless to mild steel.

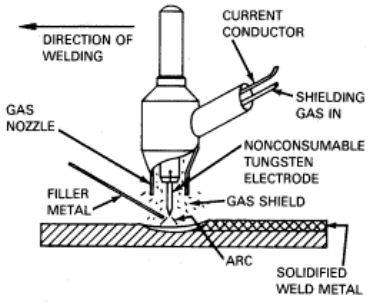


Fig. 4: Gas Tungsten Arc Welding

The advantages of GTAW are as follows;



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- Applicable to a very wide range of materials.
- Especially good for welding thin sections and delicate workpieces
- Capable of producing welds of high quality and appearance
- No Slag - No requirement for flux with this process; therefore no slag to obscure the welder's vision of the molten
- weld pool
- No Sparks or Spatter - No transfer of metal across the arc. No molten globules of spatter to contend with and no
- sparks produced if material being welded is free of contaminants
- Few fumes are produced. However, the base metals being welded may contain coatings or elements such as lead, zinc, copper,nickel, etc. that may produce hazardous fumes.
- Good for welding thin material

The disadvantages of GTAW are as follows;

- Generally restricted to flat or horizontal welding
- Hand-eye coordination is a required skill
- Brighter UV rays than other processes
- Equipment costs can be higher than other processes

**Oxyacetylene Welding (OAW)**

The oxyacetylene welding process uses a combination of oxygen and acetylene gas to provide a high temperature flame.
When mixed together in correct proportions within a hand-held torch or blowpipe, a relatively hot flame is produced with a temperature of about 3,200 deg.C. The chemical action of the oxyacetylene flame can be adjusted by changing the ratio of the volume of oxygen to acetylene. Oxygen and Acetylene are stored under pressure in steel cylinders

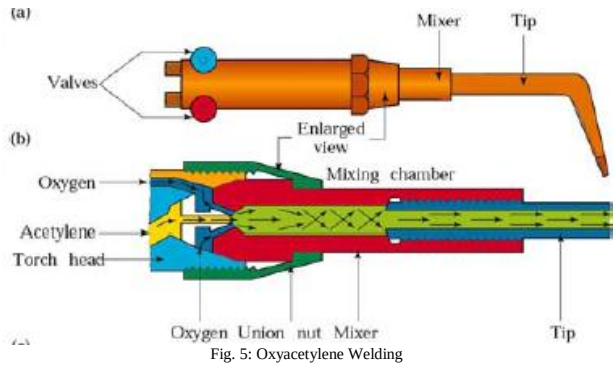

Fig. 5: Oxyacetylene Welding

The advantages of OAW are as follows;

- It's easy to learn.
- The equipment is cheaper than most other types of welding rigs
- The equipment is more portable than most other types of welding rigs
- OA equipment can also be used to "flame-cut" large pieces of material.

The disadvantages of OAW are as follows;

- OA weld lines are much rougher in appearance than other kinds of welds, and require more finishing if neatness is required.
- OA welds have large heat affected zones (areas around the weld line that have had their mechanical properties adversely affected by the welding process)
- OAW is a manual process in which the welder must personally control the the torch movement and filler rod application



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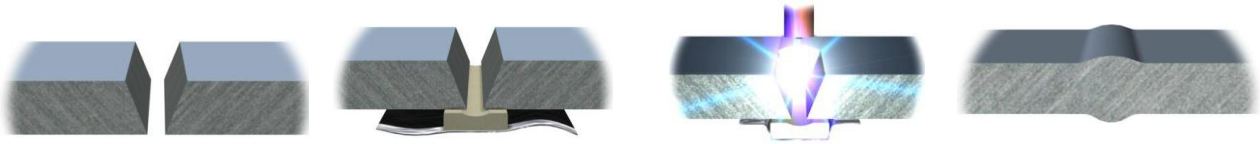
## NEW WELDING TECHNOLOGIES IN SHIPBUILDING INDUSTRY

### Ceramic Welding

In recent years, especially for the shell plate of the vessels, ceramic welding is being started to be used as a welding technique. The welding is being done by using **c**eramic weld backings. X-ray quality, full penetration welds from one side and in a single pass can be achieved with this method. On the other hand, finished high quality weld and savings of labor, materials and time are also been achieved. Weld backings can be used to compensate for poor fit-ups, and is valuable when welding conditions are not ideal or where the back side of a weld joint is inaccessable. In ceramic welding firstly welder should do root opening. Then backing is applied on the material and welding starts. After finishing welding process, ceramic backing should be removed.



(1)Root opening (2)Application of Ceramic Backing (3)Welding (4)Finishing

Fig. 6: Stages of Ceramic Welding

This method is applied for welding of the shell plates of the ships. High quality, full penetration, time and economical savings can be achieved with this method. Therefore the delivery times of the projects are being shortened.

### Robotic Welding

Robots are used in a wide range of industrial applications. The earliest applications were in materials handling, spot welding, and spray painting. Although the automotive industry is the major user of robotic welding, the usage of robotic welding is also improving in the shipbuilding industry day by day. The two basic welding types in shipbuilding are spot welding and arc welding.

Arc welding robot is one of the most common functions in industry today. During this process, electricity jumps from an electrode guided through the seam, to the metal product. This electric arc generates intense heat, enough to melt the metal at the joint. For robotic arc welding system, a much more controller is also required.

Automated welding has begun improving upon manual welding in the industry due to increasing speed, quality and throughput. The shipbuilding industry is suitable for robotic welding (Karagoz, 2001). Robot welding automation is much safer and more cost-effective. Welding can be done completely at the unreachable areas. Due to it is an automation, the faults regarding human factors willnot be come across with this method.

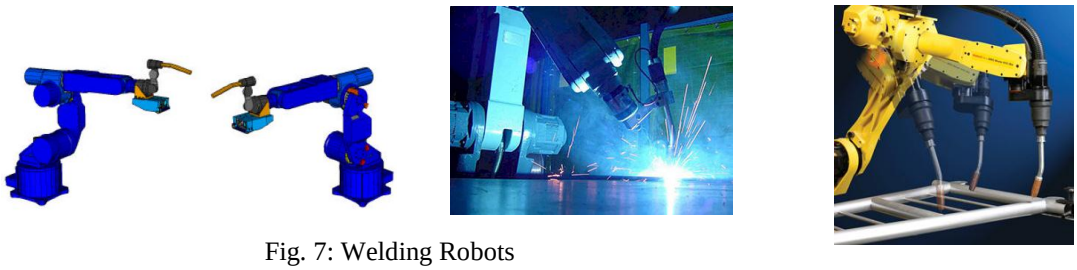


Fig. 7: Welding Robots

## CONCLUSION

The shipbuilding industry has begun to see changes in demand for its expertise. One of the important factors was the new legislation regarding "double hull" standards for safety against spillage in the event of



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a collision. This prohibits port entry for crude oil carrying vessels which do not comply to the double hull standards. Many older vessels still have a single thickness of steel between the sea and the oil storage. The new legislation has forced ship owners to invest in the new double hull technology. Another reason for the rise in shipyard activity is that much of the world's ageing shipping fleet is reaching the point where vessels can no longer be practically or economically maintained as sea-worthy. A relative stagnation in demand for new ships is being revived by the requirement for replacement vessels (Sorenti, 1997).

Competition for this increased business is global and there is a demand for suppliers to deliver high-quality products, made quickly and at the lowest possible cost. Typical of the solution to these demands is to introduce automation. Robotic technology meets quality, cost and delivery requirements and also offers flexibility in welding. Robot technology gives the means by which a shipyard can produce vessels for its customers that meet their specific needs in a cost-effective manner (i.e. profitable) and more quickly (Sorenti, 1997). The delivery times of the vessels are also shortened by this technique.

Potential safety hazards associated with arc welding include arc radiation, air contamination, electrical shock, fire and explosion, compressed gases, and other hazards. Robots were originally designed to perform the job functions of a human. Robots can replace humans in the performance of dangerous jobs and are considered beneficial for preventing industrial accidents. Ceramic welding is also important due to it lets one side welding and shortens the production period.

The stability of the welding process is very sensitive to the main welding parameters such as current, voltage, welding speed, shielding gas and arc length. A small change in the distance between the welding torch and the component being welded or a fault of a welder may produce a considerable variation in the current and in the voltage. However, in robotic welding, the welding defects sourced by the welder can be prevented.

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# INTERNATIONAL WRITING COLLABORATION STRENGTHENS PUBLISHING: NEW POLICY AND ETHICAL GUIDELINES FOR CO-AUTHORSHIP

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**Abstract:** There are several successful ingredients to publishing a manuscript in a top-level scientific journal including solid laboratory or field skills, excellent writing and management skills, and choice of journal. This paper focuses on the second aspect. In Asia, Africa, South America and the Middle East (and even in supposedly native English-speaking countries), there are numerous scientists who face serious language- and writing skill-based difficulties when writing scientific manuscripts. English and writing skills are, after the scientific base of an experiment, the most essential skills for success in science publishing. This manuscript shows and emphasizes how international writing collaboration can serve as one simple but effective solution that could result in scientific publishing success without ethical hurdles provided that strict rules and values are adhered to.
**Keywords:** collaboration, partnerships, science writing, English skills, passion for science

## The birth of a manuscript

In a recently published paper (Teixeira da Silva, 2011) I considered several aspects of how to write a manuscript for successful publication in an international scientific journal of repute. In that manuscript, I indicated that trial and error, and development of a writing skill would define a scientist's style and sense of interpretation of scientific facts, factors that can strongly influenced the success of science publishing. In a vast sea of print and online journals, it is becoming increasingly difficult to make the correct choice, and very often submission is erroneously spurred by the speed and ease of publication, dictated by weak or poor editorial or managerial policies. Nonetheless, in any field of study there are always the corner-stone journals that define quality and prestige and these, for now, should serve as the guiding beacons for publication in a scientist's field of study. Other journals of lesser quality or unknown stature can be considered, but, particularly at the nascent stage of a scientist's career, these should generally be avoided, despite giving one a sense of false satisfaction when a paper is accepted for publication.

## Making an omelet from an egg

A manuscript is not born from fresh air. An idea is born, perhaps even inspired from another, and based on a clearly defined hypothesis, leads to a series of tests that lead to data that is interpreted to either verify or disprove the original hypothesis. A well-designed experiment and solid, well-thought-of hypothesis are essential factors for a good experiment while sound statistical analyses bring confidence to a data set. The analogy: Provided a chicken is consistently healthy and productive, without a good quality egg, there is no savoury omelet.

Originality is essential. Local studies are important but generally restrictive in their target audience and application and hence more difficult to publish. Persistence, desire, passion and ambition are all personal qualities, among others (Teixeira da Silva, 2011), that will help drive the experiment forward, particularly in times of duress. Faith to some is a must.

Publishing is increasingly competitive, and over time it is becoming progressively more and more difficult to publish in top level journals, despite a strong experimental design, execution, analysis and/or originality. Even research groups that have demonstrated consistently high levels of excellence struggle. Struggle, a universal truth for all manuscripts, is a basic ingredient for the search for excellence in science publishing. In essence, an extension of human nature. Living or working in a comfort zone stimulates



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apathy and passion is easily lost, for it is has lost its essential nature. In most cases, however, to maintain a position or gain a salary, there is some level of pressure to publish and excel. However, excessive stress can lead to serious mistakes such as the incorrect choice of journal or plagiarism, all strong realities in the world of publishing.

In order to meet the challenges of today's world of publishing, scientists are left with few choices that allow them to excel beyond their personal and professional intellectual capacity. Those who have pot-bellied budgets can invest in top technology, labour and skills to ensure that they occupy the top echelon of the science publishing world. However, to most, particularly in developing countries, such funding is merely the topic of dreams. Funding is usually the number one limitation. Limited funding can result in limited studies, weaker data and restricted scope and application. And thus, a deep and wide chasm has emerged between rich and poor, developed and developing, both in society and in science. How then can those who feel the pressure of this gap, and who occupy its lower strata, become more competitive without compromising quality and ethics? And how can those privileged minority occupying the higher strata, give credit for those "below" them in ways that maintain ethical rigour while achieving scientific excellence through a spirit of true understanding?

In this paper, I propose one possible universal solution and answer to these two questions.

**A step towards publishing success**

From experience, many scientists who are not native English speakers tend to rely on pot-luck chance and submit their manuscripts to journals in a less-than-suitable state, both in terms of scientific quality and writing style. In their minds, they have felt that some limit in personal and professional capacity has been reached, and there is a reluctance to try and excel. For them, the journal that publishes instantly is the medium of choice. No effort, few problems, some reward. Enough to scrape by. Others, however, who know their inherent weaknesses, seek to improve them. This is not easy and may involve a long and gradual process of dedicated English classes, TOIEC or TOEFL tests, or private lessons to try and master writing or scientific skills. In cases related to English and scientific writing deficiencies, scientists are left with three main basic choices: 1) contact a friend to assist freely; 2) contact an English teacher or unknown native English speaker to assist freely; 3) pay for professional services to improve the manuscript. There are inherent problems with each of these. In case 1), friends generally do not have the same concern as scientists and thus tend to give very superficial and non-technical comments, which might not improve the quality at all. It is not a long-term solution. After all, how many times can you bother a friend, unless they are considerably altruistic? In many cases, friends who are also professionals have their own busy schedules and private lives, and may be reluctant to assist more than once. In case 2), English teachers on the whole are not scientists, have poor understanding of the basics of science or science writing, and can give poor or oft insufficient advice. They are the cuckoos of the science publishing world and constitute an important, but dangerous masquerade that can damage science writing through a false sense of quality, both for the scientist and the target journal. Well, I guess it is better than nothing. Many commercial text editing services often advertise their personnel as PhD graduates or master's students who are native English speakers, but this is a far cry from what is required by learned professionals who need a professional service that tackles both language and scientific rigour. In case 3), not everyone can afford professional services. On average, it will cost between $US 150-300 for a 3000-word paper that requires revision within a 10-14-day period. Naturally, more expensive services exist and higher prices for faster services. And also cheaper services, which tend to be suspect and should be altogether avoided. In many developing countries, such as in Indonesia, $US 150-300 is the equivalent of a scientist's one-month salary thus professional text editing services remain way out of reach of possibly 50-75% of the world's scientists. How then, can a scientist who is convinced of the quality and depth of their study and research abilities, reach for the stars?

By establishing a professional writing collaboration. This is the focus of this paper.

**How can it work?**

Without a doubt, finding the right partner is close to – but not – impossible. A search through major data-bases could result in suitable matches of leaders who would fit the profile of a scientist's research. However, many or most of them would probably be reticent to such an idea because: a) they follow in the traditional steps of their predecessors and thus believe that such an approach is wrong, but never question why it is considered to be wrong; 2) they have no idea how to approach the issue or how to establish the contacts; 3) they are afraid of the potential consequences because nowhere have suitable guidelines been



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established that authenticate or demonize it. This paper would bring the scientific community one step closer to authenticating the concept of international writing collaboration.

So, in my mind, the first step required to finding a suitable writing co-operation partner is to lose these three misguided and conventional misconceptions and to start with a fresh way of thinking. If a scientist knows that their research is honest, if they feel that they have fully complied to basic scientific principles in experimental design and execution, if they feel that what they have – in terms of results – is unique and original, but they recognize their personal and professional limitations in language expression and scientific writing skills, then they should seek help. If a scientist has been able to find a suitable person (professional) who they feel matches their research profile, then that person should be actively sought to recruit them in an open and transparent way. If initially that person accepts and only makes minor or superficial improvements or suggestions, then they can (and should) simply be acknowledged. If however, they make vast and significant edits and improvements to the interpretation of the data and study, to the writing and structure, and to the overall quality of science and language, even if they were not involved in experimental conception, design or execution, I am of the sincerest and strongest opinion that such a person should be a co-author without absolutely any ethical dilemmas. In other words, if a scientist is absolutely unable to write or text edit their own manuscript or feels that by inviting a high level scientist would significantly improve the quality of their text, then do so. In essence, such a professional would allow (or at least maximize the possibility) a scientist who feels that they have limitations in language or writing skills to cross the threshold between submission and acceptance. Figure 1 provides a flow diagram of how to reduce the redundant options and try to find individuals who would fit the perfect profile to achieve the task.

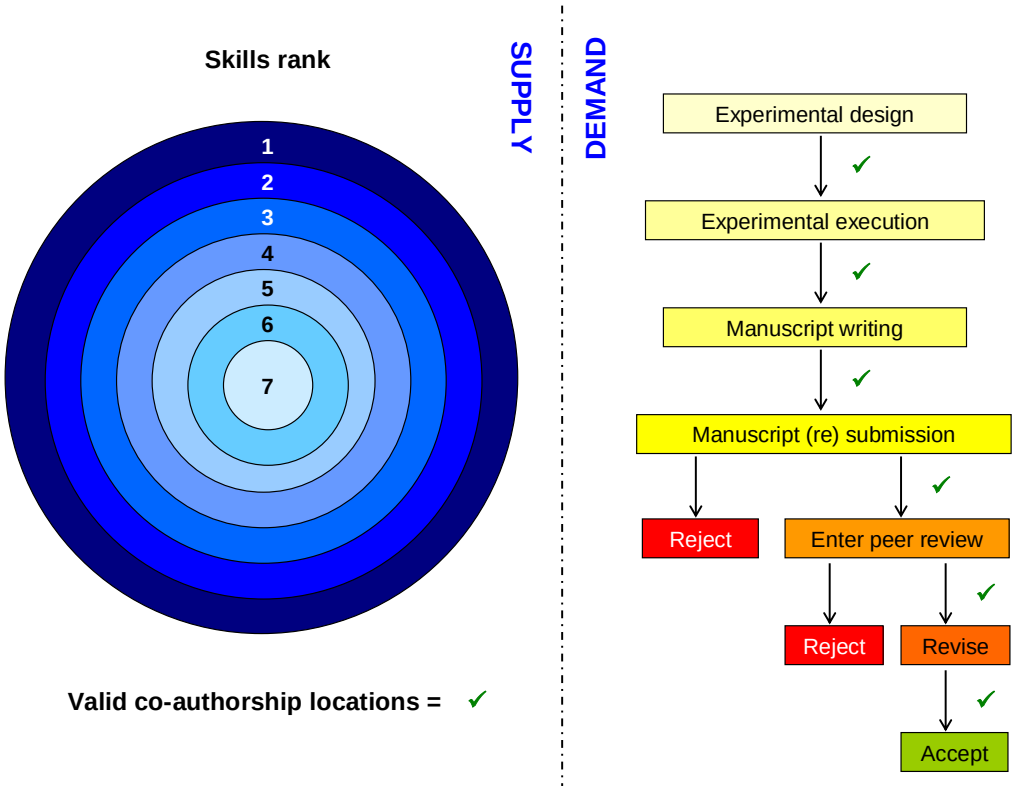


Figure 1. A "bull's eye" scheme of how to track and identify the ideal international CPC through seven levels of selection: a self-appraised analysis of why the author would be the ideal candidate. Most likely the supply would always exceed the demand. 1) All scientists. 2) Plant scientist, including experience from multiple fields, including agronomy, agriculture, horticulture, genetics, botany. 3) Scientist with > 20 years research and/or publishing experience. 4) Scientist with over 300 international peer-reviewed publications, including journals and books and with a cumulative IF® score > 100. 5) Scientist with multicultural and multilingual (3-5 languages) experience and who is also a native English speaker. 6) Editing and reviewing of > 5000 manuscripts. 7) Editor in Chief of > 20 journals. Validity = validity (ethically, philosophically



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and otherwise) of a scientist with all 7 ranked qualifications to become a co-author when providing significant linguistic and scientific support to a research team as a international writing CPC.

Of course, the reader will know that this is most likely a hot bed of contention and will be subject to very strong and polarized opinions, no doubt. However, to those for whom such a co-operation brings genuine improvement at no cost, and a true chance to excel and publish in a level of journal that might have previously seemed unimaginable, a new spark of hope will be born. What will emerge is a new generation of scientist with a novel level of partnership, fortifying science through excellence in writing. A new class of ethics in science writing will develop, subject to challenges and criticisms in parallel to its powerful team-building capacity. Ideally, it may give a scientist – even an established scientist who has reached a plateau in writing ability – greater confidence, through learning, as to how to better improve their own writing skills until they are confident enough to complete this task on their own. At that point, the co-operation might even cease to exist, and a new-born scientist will emerge. This is very different to the *neo-cientista* or *pseudo-cientista* (pseudo scientists) – terms coined by the author – discussed elsewhere (Teixeira da Silva, 2011).

**How is it implemented? Co-operation ABC**

The agreement held between parties must never result in conflicts of interest with co-authors, with the research institute where the research was conducted or with funding bodies. This is a complex and highly sensitive topic and in the current world of science there is a rift as to who agrees or disagrees that such co-operation constitutes ethical practice in science publishing, a so-called grey zone in science publishing. Thus, to avoid confusion and to ensure that the ethics of such a writing co-operation are sound, we need to approach science publishing in this form in a step-by-step manner.

Personally, when such an international co-operation of this type is established, I always recommend setting out the most rigorous ethical policies possible. These are of course only guidelines and should be set to meet the individual requirements of that research group or study, and will need to be adjusted to suit a particular research group, institute or situation. However, this set of guidelines that I propose can serve as an essential skeleton based on which trust is built. One should always insist and request all co-operation partners to agree to each and every single point, without exception. Those points which I most recommend are:

a) This co-operation exists with an understanding that this work is original, has not been published before, has been executed in the most scientifically rigorous manner possible, and is not been considered for more than one journal.
b) This co-operation exists with an understanding that there are no conflicts of interest between any of the co-authors, between any of the authors and research institutes and/or funding bodies.
c) Any possible conflicts of interest that have not been fully and openly declared are and will be the FULL responsibility of the host research author(s) and institute.
d) Submission is also the FULL responsibility of the host research author(s) unless specifically requested due to difficulties with language or complexity of online submission systems. In that case, I will serve only as the vehicle for submission but the original authors will remain the official authors for correspondence in the manuscript itself.
e) The functions performed by me (upon request) include advice on data analysis, advice on experimental design and analysis, critical assessment and evaluation of scientific content, and language improvement, each to a different extent, but all-inclusive nonetheless.
f) It is understood that such a co-operation is NOT standard BUT constitutes a unique, but not unethical, means of co-operation, as established by all parties concerned. Independent of this co-operation, the ethical guidelines set out by relevant journals, research institutes, funding bodies and publishers will be fully respected.
g) Submission of this manuscript to any and all future journals implies that all conditions a) to f) have been read by all parties and are fully understood.
h) To ensure that all conditions are met, each revision and submission steps will be communicated to all authors by e-mail. This is done to avoid any misunderstandings or conflicts and to promote full transparency and open communication and discussion at each step of the editing process.



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i) The choice of journal, publisher and publishing medium (online or print, journal or book), format (open access or paid subscription), and level of quality (with or without Impact Factor®) will be decided upon by consensus.

If even as little as one of these requirements is not met, I strongly recommend that the co-operation not take place due to conflicts of interest, personal, or professional, and that other alternatives be sought.

**Practical examples**

In general, writing co-operation can also fulfill, in addition to improving limits and gaps in linguistic and science writing skills, other functions. What follows is a small but significant sample of co-operation writing manuscripts that have been written under the umbrella of scientific writing co-operation, fully ethically approved by all authors and under the strictest possible rigor at all levels of scientific execution and editing. These examples are classed under three classes of assessment:

1. If you are sure that the research you have done is unique, you are absolutely unable to find any literature on the topic and you are convinced that your findings are good, not necessarily *Science* or *Nature* level, but you are afraid of your personal limits, then seek a science writing co-operation partnership. By identifying a unique "gap" in science where a new discovery could be made is an extremely important part of science publishing, but being unable to expose it is the worst possible outcome that could face weeks or months of hard lab or field work. Despite the long history of apple tissue culture and biotechnology (Dobránszki and Teixeira da Silva, 2010, Magyar-Tábori et al.,2010), no one had ever attempted to apply thin cell layer technology to apple regeneration (Dobránszki and Teixeira da Silva, 2011). One's own ideas should never be shunned, one should never be shy about a modest dream to discover something (Tanaka et al., 2010), and never be afraid to ask for help, even the leaders of a field of study, in trying to achieve it (Teixeira da Silva et al., 2007).
2. While trying to disprove a null hypothesis, how novel would your results be? Would you consider your own results to be of high international value (Teixeira da Silva, 2003), high value but geographically localized (Teixeira da Silva et al., 2000), or of low practical value or regional interest because there are too few samples or only a single variety is used (Teixeira da Silva and M. Tanaka, 2009), even if molecular work is involved (Teixeira da Silva and Tanaka, 2009)? In general most journals require results to be tested on more than one cultivar or multi-season trials (Ruan and Teixeira da Silva and Qin, 2010). However, on occasion, plant material is scant, growth is slow and thus results in some journals that pertain only to a single cultivar or single season of data can often be represented as a research note (Ding et al., 2010) because that plant material or research is of value even though the experimental design is simple (Teixeira da Silva and Tanaka, 2006, Teixeira da Silva, 2005).
3. Even if the results are not that interesting or novel, do you have the creative ability to make the story surrounding the data interesting (Teixeira da Silva, 2003)? Even if the methodology used is not that popular, especially in this day and age of molecular advances, can you still show the effectiveness of simple but powerful techniques (Winarto et al.,2010)? Many top level journals receive dozens if not hundreds of manuscripts a month and often there is a first phase of selection. During this phase, even if the results are fairly simplistic, provided that they can show some futuristic application or provided that they indicate an extension of a concept, the chances of acceptance, even with only a single set of data, are high e.g. (Dobránszki and Teixeira da Silva, 2011). If you feel that something has never been researched before, possibly because the concept would be laughable, ignore those laughs, and follow your gut feeling and scientific base (Teixeira da Silva, 2011). More often than not, you will be the last one laughing (Teixeira da Silva, 2003, Mariani et al., 2011).

Based on these three initial assessments, a journal should then be selected that would best correspond to the estimated quality and level of the manuscript's scientific value. Always aim for a slightly higher level journal that you would expect to publish in at first (if time permits) and then downgrade later if necessary. The value of books is rapidly diminishing (in my opinion), and unless the publisher can provide a top-class product on high-quality print medium (Teixeira da Silva and Tanaka), with a perfect finish, your best bet is to aim for a respectable journal instead.

Nowadays, there is a wealth of online and Open Access journals, all with their merits and demerits, almost springing up weekly, and the scientist's choices, although apparently wider, are also more dangerous, because the risks are much higher. Proceed with caution!



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## CONCLUSION

Writing a scientific paper for an international journal is for some a pleasant experience while for others it is a stressful one. Most certainly it will contain both aspects but hopefully within the text above you may find at least one point that might lead you closer to having your important research results published more easily and more effectively. Remember that a manuscript that is well written (style-wise) and which contains clear and grammatically correct English, that follows the style of the journal and that proves the hypotheses initially set out in the Introduction will have already fulfilled half of the requirements for publication in any journal. The remainder depends on the quality of the research that was conducted, on the scientific merit and uniqueness and on the strictness of the review process.

Partnerships and collaboration are no longer only limited to intra-lab or intra-institutional group work. Neither are they limited to grandiose and excessive budget-blowing cocktail parties across international lines. The concept of collaboration is simple. Assistance that results in a significantly higher quality constitutes an ethical and acceptable form of co-authorship provided it is done under the most rigorous ethical guidelines and execution possible (Teixeira da Silva, 2011). Excellence is a two-way street that can only be achieved in an increasingly competitive world of science publishing by establishing partnerships at two primary levels: laboratory skills and scientific writing.

Those who have reached the limits of their professional writing endeavours and are unable to excel despite their efforts need to seek professional assistance. Those who can just pay for it… well, don't even bother to read this paper!

## ACKNOWLEDGEMENT AND NOTE

I wish to thank Pham Thanh Van for all her forms of support. This text is dedicated to all those scientists who are inspired by my passion to make their publishing dreams a reality. This message is for and about you: "Lionel Logue: *Why should I waste my time listening to you?* King George VI: *Because I have a voice!* Lionel Logue: *...yes, you do.*" (The King's Speech, 2010).

About the author: Dr. Jaime A. Teixeira da Silva graduated from The University of the Witwatersrand, South Africa, majoring in Botany and Genetics. He has held research positions, including post-docs, at Lisbon University, Portugal and Kagawa University, Japan. His PhD is in ornamental biotechnology. He has published or co-authored over 70 book chapters and 250 peer-reviewed papers, with between 50 and 70 in review or preparation and has a cumulative IF® score of >120. He is the founder, former CEO/CSO and current Editor-in-Chief of Global Science Books (www.globalsciencebooks.info).

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In this paper, I propose one possible universal solution and answer to these two questions.

## A step towards publishing success

From experience, many scientists who are not native English speakers tend to rely on pot-luck chance and submit their manuscripts to journals in a less-than-suitable state, both in terms of scientific quality and writing style. In their minds, they have felt that some limit in personal and professional capacity has been reached, and there is a reluctance to try and excel. For them, the journal that publishes instantly is the medium of choice. No effort, few problems, some reward. Enough to scrape by. Others, however, who know their inherent weaknesses, seek to improve them. This is not easy and may involve a long and gradual process of dedicated English classes, TOIEC or TOEFL tests, or private lessons to try and master writing or scientific skills. In cases related to English and scientific writing deficiencies, scientists are left with three main basic choices: 1) contact a friend to assist freely; 2) contact an English teacher or unknown native English speaker to assist freely; 3) pay for professional services to improve the manuscript. There are inherent problems with each of these. In case 1), friends generally do not have the same concern as scientists and thus tend to give very superficial and non-technical comments, which might not improve the quality at all. It is not a long-term solution. After all, how many times can you bother a friend, unless they are considerably altruistic? In many cases, friends who are also professionals have their own busy schedules and private lives, and may be reluctant to assist more than once. In case 2), English teachers on the whole are not scientists, have poor understanding of the basics of science or science writing, and can give poor or oft insufficient advice. They are the cuckoos of the science publishing world and constitute an important, but dangerous masquerade that can damage science writing through a false sense of quality, both for the scientist and the target journal. Well, I guess it is better than nothing. Many commercial text editing services often advertise their personnel as PhD graduates or master's students who are native English speakers, but this is a far cry from what is required by learned professionals who need a professional service that tackles both language and scientific rigour. In case 3), not everyone can afford professional services. On average, it will cost between $US 150-300 for a 3000-word paper that requires revision within a 10-14-day period. Naturally, more expensive services exist and higher prices for faster services. And also cheaper services, which tend to be suspect and should be altogether avoided. In many developing countries, such as in Indonesia, $US 150-300 is the equivalent of a scientist's one-month salary thus professional text editing services remain way out of reach of possibly 50-75% of the world's scientists. How then, can a scientist who is convinced of the quality and depth of their study and research


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abilities, reach for the stars?

By establishing a professional writing collaboration. This is the focus of this paper.

## How can it work?

Without a doubt, finding the right partner is close to – but not – impossible. A search through major data-bases could result in suitable matches of leaders who would fit the profile of a scientist's research. However, many or most of them would probably be reticent to such an idea because: a) they follow in the traditional steps of their predecessors and thus believe that such an approach is wrong, but never question why it is considered to be wrong; 2) they have no idea how to approach the issue or how to establish the contacts; 3) they are afraid of the potential consequences because nowhere have suitable guidelines been established that authenticate or demonize it. This paper would bring the scientific community one step closer to authenticating the concept of international writing collaboration.

So, in my mind, the first step required to finding a suitable writing co-operation partner is to lose these three misguided and conventional misconceptions and to start with a fresh way of thinking. If a scientist knows that their research is honest, if they feel that they have fully complied to basic scientific principles in experimental design and execution, if they feel that what they have – in terms of results – is unique and original, but they recognize their personal and professional limitations in language expression and scientific writing skills, then they should seek help. If a scientist has been able to find a suitable person (professional) who they feel matches their research profile, then that person should be actively sought to recruit them in an open and transparent way. If initially that person accepts and only makes minor or superficial improvements or suggestions, then they can (and should) simply be acknowledged. If however, they make vast and significant edits and improvements to the interpretation of the data and study, to the writing and structure, and to the overall quality of science and language, even if they were not involved in experimental conception, design or execution, I am of the sincerest and strongest opinion that such a person should be a co-author without absolutely any ethical dilemmas. In other words, if a scientist is absolutely unable to write or text edit their own manuscript or feels that by inviting a high level scientist would significantly improve the quality of their text, then do so. In essence, such a professional would allow (or at least maximize the possibility) a scientist who feels that they have limitations in language or writing skills to cross the threshold between submission and acceptance. Figure 1 provides a flow diagram of how to reduce the redundant options and try to find individuals who would fit the perfect profile to achieve the task.


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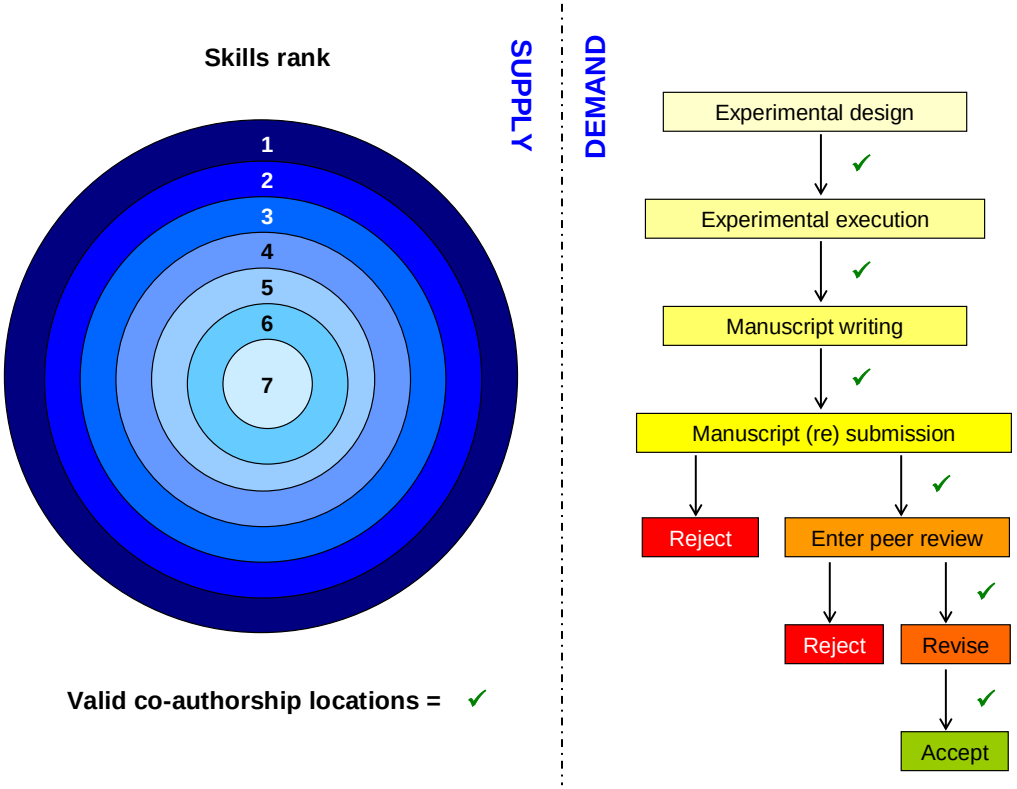


**Figure 1.** A "bull's eye" scheme of how to track and identify the ideal international CPC through seven levels of selection: a self-appraised analysis of why the author would be the ideal candidate. Most likely the supply (of CPCs) would always be grossly exceed by demand (of authors requiring a CPC) at an estimated ratio of 1000: 1. 1) All scientists. 2) Plant scientist, including experience from multiple fields, including agronomy, agriculture, horticulture, genetics, botany. 3) Scientist with > 20 years research and/or publishing experience. 4) Scientist with over 400 international peer-reviewed publications, including journals and books and with a cumulative IF® score > 165. 5) Scientist with multicultural and multilingual (3-5 languages) experience and who is also a native English speaker. 6) Editing and reviewing of > 7500 manuscripts. 7) Editor in Chief of > 20-25 journals. Validity = validity (ethically, philosophically and otherwise) of a scientist with all 7 ranked qualifications to become a co-author when providing significant linguistic and scientific support to a research team as a international writing CPC. In other words, the CPC must be a validated, well-accredited and well-established peer.

Of course, the reader will know that this is most likely a hot bed of contention and will be subject to very strong and polarized opinions, no doubt. However, to those for whom such a co-operation brings genuine improvement at no cost, and a true chance to excel and publish in a level of journal that might have previously seemed unimaginable, a new spark of hope will be born. What will emerge is a new generation of scientist with a novel level of partnership, fortifying science through excellence in writing. A new class of ethics in science writing will develop, subject to challenges and criticisms in parallel to its powerful team-building capacity. Ideally, it may give a scientist – even an established scientist who has reached a plateau in writing ability – greater confidence, through learning, as to how to


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better improve their own writing skills until they are confident enough to complete this task on their own. At that point, the co-operation might even cease to exist, and a new-born scientist will emerge. This is very different to the *neo-cientista* or *pseudo-cientista* (pseudo scientists) – terms coined by the author – discussed elsewhere (Teixeira da Silva 2011a).

## How is it implemented? Co-operation ABC

The agreement held between parties must never result in conflicts of interest with co-authors, with the research institute where the research was conducted or with funding bodies. This is a complex and highly sensitive topic and in the current world of science there is a rift as to who agrees or disagrees that such co-operation constitutes ethical practice in science publishing, a so-called grey zone in science publishing. Thus, to avoid confusion and to ensure that the ethics of such a writing co-operation are sound, we need to approach science publishing in this form in a step-by-step manner.

Personally, when such an international co-operation of this type is established, I always recommend setting out the most rigorous ethical policies possible. These are of course only guidelines and should be set to meet the individual requirements of that research group or study, and will need to be adjusted to suit a particular research group, institute or situation. However, this set of guidelines that I propose can serve as an essential skeleton based on which trust is built. One should always insist and request all co-operation partners to agree to each and every single point, without exception. Those points which I most recommend are:

a) This co-operation exists with an understanding that this work is original, has not been published before, has been executed in the most scientifically rigorous manner possible, and is not been considered for more than one journal.

b) This co-operation exists with an understanding that there are no conflicts of interest between any of the co-authors, between any of the authors and research institutes and/or funding bodies.

c) Any possible conflicts of interest that have not been fully and openly declared are and will be the FULL responsibility of the host research author(s) and institute.

d) Submission is also the FULL responsibility of the host research author(s) unless specifically requested due to difficulties with language or complexity of online submission systems. In that case, I will serve only as the vehicle for submission but the original authors will remain the official authors for correspondence in the manuscript itself.


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e) The functions performed by me (upon request) include advice on data analysis, advice on experimental design and analysis, critical assessment and evaluation of scientific content, and language improvement, each to a different extent, but all-inclusive nonetheless.

f) It is understood that such a co-operation is NOT standard BUT constitutes a unique, but not unethical, means of co-operation, as established by all parties concerned. Independent of this co-operation, the ethical guidelines set out by relevant journals, research institutes, funding bodies and publishers will be fully respected.

g) Submission of this manuscript to any and all future journals implies that all conditions a) to f) have been read by all parties and are fully understood.

h) To ensure that all conditions are met, each revision and submission steps will be communicated to all authors by e-mail. This is done to avoid any misunderstandings or conflicts and to promote full transparency and open communication and discussion at each step of the editing process.

i) The choice of journal, publisher and publishing medium (online or print, journal or book), format (open access or paid subscription), and level of quality (with or without Impact Factor®) will be decided upon by consensus.

If even as little as one of these requirements is not met, I strongly recommend that the co-operation not take place due to conflicts of interest, personal, or professional, and that other alternatives be sought.

## Practical examples

In general, writing co-operation can also fulfill, in addition to improving limits and gaps in linguistic and science writing skills, other functions. What follows is a small but significant sample of co-operation writing manuscripts that have been written under the umbrella of scientific writing co-operation, fully ethically approved by all authors and under the strictest possible rigor at all levels of scientific execution and editing. These examples are classed under three classes of assessment:

1. If you are sure that the research you have done is unique, you are absolutely unable to find any literature on the topic and you are convinced that your findings are good, not necessarily *Science* or *Nature* level, but you are afraid of your personal limits, then seek a science writing co-operation partnership. By identifying a unique “gap” in science where a new discovery could be made is an extremely important part of science publishing, but being unable to expose it is the worst possible outcome that could face weeks or months of hard lab or field work. Despite the long history of apple tissue culture and biotechnology (Dobránszki and Teixeira da Silva, 2010;


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Magyar-Tábori et al. 2010), no one had ever attempted to apply thin cell layer technology to apple regeneration (Dobránszki and Teixeira da Silva, 2011). One's own ideas should never be shunned, one should never be shy about a modest dream to discover something (Tanaka et al. 2010), and never be afraid to ask for help, even the leaders of a field of study, in trying to achieve it (Teixeira da Silva et al. 2007).

2. While trying to disprove a null hypothesis, how novel would your results be? Would you consider your own results to be of high international value (Teixeira da Silva, 2003a), high value but geographically localized (Teixeira da Silva et al. 2000), or of low practical value or regional interest because there are too few samples or only a single variety is used (Teixeira da Silva and Tanaka, 2009a), even if molecular work is involved (Teixeira da Silva and Tanaka, 2009b)? In general most journals require results to be tested on more than one cultivar or multi-season trials (Ruan et al. 2010). However, on occasion, plant material is scant, growth is slow and thus results in some journals that pertain only to a single cultivar or single season of data can often be represented as a research note (Ding et al. 2010) because that plant material or research is of value even though the experimental design is simple (Teixeira da Silva, 2005; Teixeira da Silva and Tanaka, 2006).
3. Even if the results are not that interesting or novel, do you have the creative ability to make the story surrounding the data interesting (Teixeira da Silva, 2003b)? Even if the methodology used is not that popular, especially in this day and age of molecular advances, can you still show the effectiveness of simple but powerful techniques (Winarto et al. 2010)? Many top level journals receive dozens if not hundreds of manuscripts a month and often there is a first phase of selection. During this phase, even if the results are fairly simplistic, provided that they can show some futuristic application or provided that they indicate an extension of a concept, the chances of acceptance, even with only a single set of data, are high e.g. (Dobránszki and Teixeira da Silva, 2011). If you feel that something has never been researched before, possibly because the concept would be laughable, ignore those laughs, and follow your gut feeling and scientific base (Teixeira da Silva, 2011b). More often than not, you will be the last one laughing (Teixeira da Silva, 2003c; Mariani et al. 2011).

Based on these three initial assessments, a journal should then be selected that would best correspond to the estimated quality and level of the manuscript's scientific value. Always aim for a slightly higher level journal that you would expect to publish in at first (if time permits) and then downgrade later if necessary. The value of books is rapidly diminishing (in my opinion), and unless the publisher can provide a top-class product on high-quality print medium (Teixeira da Silva and Tanaka, 2011), with a perfect finish, your best bet is to aim for a respectable journal instead.


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Nowadays, there is a wealth of online and Open Access journals, all with their merits and demerits, almost springing up weekly, and the scientist's choices, although apparently wider, are also more dangerous, because the risks are much higher. Proceed with caution!

## SUMMARY AND CONCLUSION

Writing a scientific paper for an international journal is for some a pleasant experience while for others it is a stressful one. Most certainly it will contain both aspects but hopefully within the text above you may find at least one point that might lead you closer to having your important research results published more easily and more effectively. Remember that a manuscript that is well written (style-wise) and which contains clear and grammatically correct English, that follows the style of the journal and that proves the hypotheses initially set out in the Introduction will have already fulfilled half of the requirements for publication in any journal. The remainder depends on the quality of the research that was conducted, on the scientific merit and uniqueness and on the strictness of the review process.

Partnerships and collaboration are no longer only limited to intra-lab or intra-institutional group work. Neither are they limited to grandiose and excessive budget-blowing cocktail parties across international lines. The concept of collaboration is simple. Assistance that results in a significantly higher quality constitutes an ethical and acceptable form of co-authorship provided it is done under the most rigorous ethical guidelines and execution possible (Teixeira da Silva, 2011c). Excellence is a two-way street that can only be achieved in an increasingly competitive world of science publishing by establishing partnerships at two primary levels: laboratory skills and scientific writing. There is more than an abundance of evidence suggesting the success of ethical collaborative publishing, independent of culture, creed or country (Zeng et al. 2011; Teixeira da Silva and Muscolo, 2012), even though there continue to be sharp divides as to what constitutes a valid author, at least within the plant sciences (Teixeira da Silva and Van, 2011).

Those who have reached the limits of their professional writing endeavours and are unable to excel despite their efforts need to seek professional assistance. Those who can just pay for it… well, don't even bother to read this paper!

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I wish to thank Pham Thanh Van for all her forms of support. This text is dedicated to all those scientists who are inspired by my passion to make their publishing dreams a reality. This message is for and about you: "Lionel Logue: *Why should I waste my time listening to you?* King George VI: *Because I have a voice!* Lionel Logue: *...yes, you do.*"


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(The King's Speech, 2010). About the author: Dr. Jaime A. Teixeira da Silva graduated from The University of the Witwatersrand, South Africa, majoring in Botany and Genetics. He has held research positions, including post-docs, at Lisbon University, Portugal and Kagawa University, Japan. His PhD is in ornamental biotechnology. He has published or co-authored over 75 book chapters and 300 peer-reviewed papers, with between 50 and 70 in review or preparation and has a cumulative IF® score of >165. He is the founder, former CEO/CSO and current Editor-in-Chief of Global Science Books (www.globalsciencebooks.info).

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