Accredited Analytical Testing Services Laboratory as a Reference Laboratory for the Oil Palm Industry

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INTRODUCTION

The Malaysian palm oil industry has experienced significant growth since the first introduction of oil palm from West Africa in the late 1870s. In 2016, crude palm oil (CPO) production was recorded at 17.32 million tonnes (MPOB, 2016). Malaysia is currently one of the leading producers and exporters of palm oil (PO) and palm oil products (POP) worldwide. This accounts for 11% of the oils and fats production, and 27% of the exports of oils and fats (Malaysian Palm Oil Council, 2017).

A consistent and predictable supply of palm kernel oil (PKO) and PO has led to the development of oleochemical industry in the country. The industry, which started in 1980, is now one of the largest oleochemicals complex in the world, with a production capacity of about 2.734 million tonnes and the export of oleochemical products amounted to 2.76 million tonnes in 2016 (MPOB, 2016). Most of the PO produced is used for food purposes and less than 20% of the PO goes into the non-food applications. Although smaller in volume, this is an important area of application as most of the POP are further processed into higher value-added products.

As the entrusted guardian championing the well-being of the oil palm industry, the Malaysian Palm Oil Board (MPOB) plays a crucial role in enabling the smooth operation of the industry. Consequently, MPOB focuses its endeavours on upholding quality across all related industries to become a global benchmark of standards and excellence.

The Advanced Oleochemical Technology Centre (AOTC) was established in 1994 as a unit under the Engineering and Processing Division (formerly Chemistry and Technology Division) in MPOB with the objective of looking into the R&D in non-food applications, oleochemicals and oil palm downstream activities in Malaysia. Due to the expansion in terms of manpower, facilities and responsibilities, AOTC was upgraded in 2004 to a full fledge R&D division, known as Advanced Oleochemical Technology Division (AOTD), with the objective of spearheading the oleochemicals downstream activities in Malaysia beyond basic oleochemicals. Oleochemicals have been identified as one of the growth areas according to the 3rd Malaysian Plan, which is also in line with the Malaysian government aspiration under the Economic Transformation Programme (ETP) for PO since 2010.

In a bid to ensure that Malaysia's PO exports meet the required specifications of its local and international buyers, MPOB (through AOTD) has established the Analytical Testing Services (ATS) Laboratory which focuses on providing analytical services to the industry (*Figure 1*). As a responsible government agency laboratory specialising in PO testing, the ATS Laboratory aims to provide the PO industry worldwide an accurate, prompt and independent services in accordance with the procedures laid down in the Laboratory Quality Manual and Standard Operating Procedures. In the absence of evidence to support the accuracy of the analytical results carried out by the laboratory, the integrity and reliability of the data produced may be questioned by various parties. This will also affect MPOB's reputation in producing high quality research and meeting the needs of the customers. Therefore, in order to ensure the tests conducted and results obtained from this laboratory are internationally recognised, AOTD has implemented the quality management system MS ISO/IEC 17025 (general requirements for the competence of testing and calibration laboratories). It is the single most important standard for

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Tocotrienols: Emerging Evidence of Health Benefits from Clinical Trials

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INTRODUCTION

Vitamin E was discovered in the 1920s and has exhibited various health protective effects (Aggarwal *et al*., 2010; Fu *et al*., 2014). It consists of tocopherols (TP) and tocotrienols (T3) with tocotrienols being different from their counterpart due to the presence of an unsaturated side chain. Compared to other natural sources such as soyabean, corn and rice bran, palm oil has a higher ratio of tocotrienols to tocopherols (Kannappan *et al*., 2012). For many years, vitamin E has been referred to synonymously as alpha tocopherol. However, in the last three decades, scientific evidence has shown that tocotrienols are much more potent as antioxidants than alpha tocopherol. In addition, tocotrienols have shown such therapeutic effects as neuroprotective, cardioprotective and anti-cancer, and as a cholesterol lowering agent as shown in *Figure 1* (Fu *et al.,* 2014). From pre-clinical studies to clinical trials, many mechanisms have been elucidated in the quest of an explanation for tocotrienols' health-promoting qualities. This article will discuss the important findings from clinical trials that can serve as a bridge to connect scientists and clinicians.

CARDIOVASCULAR HEALTH

Long-term supplementation with vitamin E has been associated with reduced risk of cardiovascular disease. Fueled by promising results from pre-clinical research, numerous human clinical studies have been carried out to investigate the effects of tocotrienol supplementation on lipid parameters such as triglycerides (TG), total cholesterol (TC), high-density lipoprotein (HDL) and low density lipoprotein (LDL) (Meganathan and Fu, 2016). Tocotrienols have been reported to exert cholesterol-reducing activity (Yuen *et al.,* 2011; Fu *et al.,* 2014). A study was conducted on hypercholesterolemic subjects supplemented with tocotrienol-rich fractions (TRF). Statistically significant decreases in TC and LDL were reported following TRF supplementation in these subjects (Qureshi *et al.,* 1991; 1997; 2001; 2002; Yuen *et al.,* 2011). However, no remarkable outcomes were observed in two subsequent studies involving hypercholesterolemic subjects supplemented with up to 240 mg TRF per day (Wahlqvist *et al.,* 1992; Mensink *et al.*, 1999). Interestingly, a combination of 50 mg of TRF, lovastatin (a cholesterol-lowering drug) and the American Heart Association (AHA) step 1 diet resulted in a reduction in TC and LDL levels (Qureshi *et al.,* 2001). It was postulated that the plasma T3 levels were insufficient to exert any physiological effect and that there also existed individual variations (Qureshi *et al.,* 1991).

TRF supplementation in type 2 diabetes mellitus patients was shown to decrease LDL, TC and TG. Notably, plasma glucose as well as glycated hemoglobin (HbA1c) levels were also reduced after 60 days of supplementation (Baliarsingh *et al.,* 2005). Increased risk of cardiovascular diseases is commonly linked with end-stage renal disease. In a study conducted in Detroit, USA, a decrease in plasma TG was reported in chronic hemodialysis patients supplemented with TRF for 16 weeks (Daud *et al.,* 2013).

CANCER

Apart from being a potent antioxidant, T3 has shown anti-cancer activities by preventing the proliferation of and contributing to the programmed death of cancer cells, preventing the growth of new blood vessels in the tumour site, and enhancing immune surveillance to eliminate the mutated cancer cells (Nesaretnam *et al.,* 2012). Fueled

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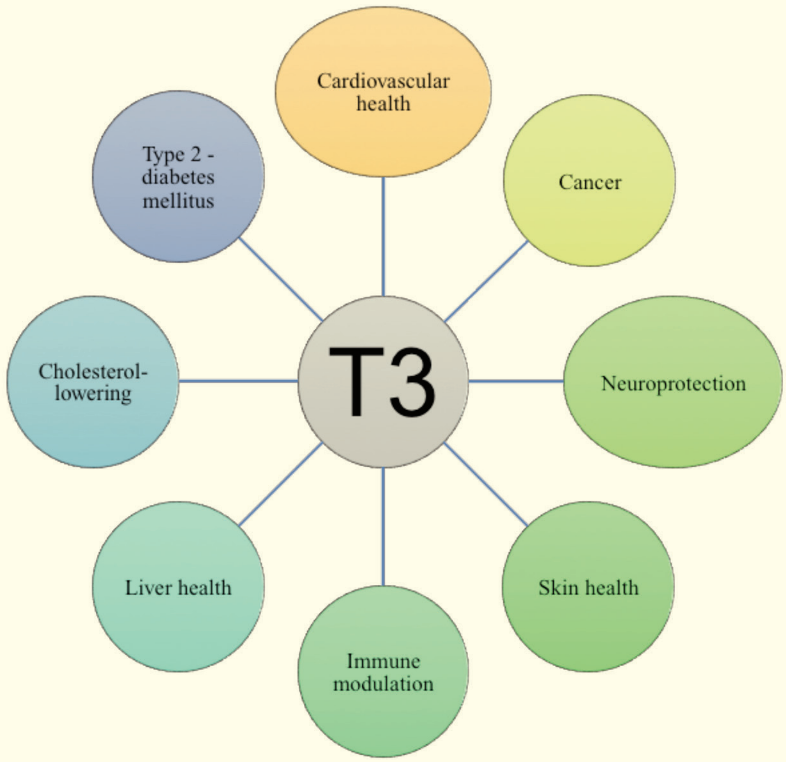

Figure 1. Therapeutic properties of tocotrienols investigated in clinical trials.

by promising evidence from cell and animal studies, a group of eminent researchers from MPOB led by Dr Kalanithi Nesaretnam embarked on a first ever pilot clinical trial on breast cancer patients at the Kuala Lumpur General Hospital. A total of 240 women with early breast cancer were allocated into two groups wherein all of them received the standard care, *i.e.* Tamoxifen, with either the addition of 400 mg of TRF (Tocovid Suprabio®) or placebo capsules, daily for five years. At the end of the five-year study, six women in the placebo group had died as compared with two women in the TRF group. The results from this study, however, were deemed to be clinically insignificant due to the low number of subjects recruited at an early stage of cancer to detect death as a primary outcome (Nesaretnam *et al.*, 2010). Nevertheless, an important outcome suggested by this study was that one out of 30 women could be saved from dying from breast cancer through TRF supplementation (Nesaretnam *et al.*, 2012). This was indeed the finding that attracted the attention of scientists and health care providers. Eventually five years later, another study was conducted in pre-operative pancreatic cancer patients in Moffitt, USA. Delta tocotrienols of different dosages, ranging from 200 to 3200 mg daily, were supplemented to different groups of patients for two weeks prior to their surgery. Interestingly, delta-T3 supplementation was found to increase apoptosis, which is programmed cell death, in the tumour cells in these patients (Springett *et al.*, 2015).

IMMUNE MODULATION

Immunomodulatory effects of T3 have gained prominence in recent years. In 2009, a study was conducted on healthy subjects to assess the immune parameters such as B and T lymphocytes and natural killer cells following TRF supplementation. However, no significant difference was reported in terms of these immune parameters at the end of the study (Radhakrishnan *et al.*, 2009). A subsequent study was conducted by the same team of researchers investigating the changes in immune response in healthy volunteers supplemented with TRF and challenged with tetanus toxoid vaccination. Interestingly, following the vaccination, statistically significant levels of immune cells were reported in these subjects, indicating a potential role of tocotrienols in enhancing immune response (Mahalingam *et al.*, 2011).

Another study carried out on TRF-supplemented smokers and non-smokers in Malaysia only showed an elevation of B cells in the non-smokers. The possible reasons for the imperceptible changes in the smokers could be that supplementation was with only 200 mg per day of TRF, and because of the presence of high baseline readings for the measured parameters (Jubri *et al.*, 2013).

NEUROPROTECTION AND COGNITIVE FUNCTION

Tocotrienols have shown potent neuroprotective effects in pre-clinical research, and this led to translational studies in humans. Only a nanomolar concentration of alpha-T3 was required to exert neuroprotection, and therefore the plasma T3 concentrations were found to be adequate in conferring protection (Patel *et al.*, 2012; Meganathan and Fu, 2016). White matter lesions (WML) have been associated with neurodegeneration. Two years of TRF supplementation in patients with WML have shown remarkable reduction in mean WML volume, indicating the therapeutic effect of T3 in providing neuroprotection (Gopalan *et al.*, 2014).

Attention deficit/hyperactive disorder (ADHD) is a behavioural disorder observed in school-going children and has been attributed to oxidative stress. The conventional medication used to manage this condition has been associated with adverse side-effects. The effect of TRF which is a potent antioxidant was investigated in these children.

After six months of supplementation with 200 mg of TRF, no significant findings were reported, and this was probably due to the fact that supplementation was introduced at an older age (Tan *et al.*, 2016).

SKIN HEALTH

One of the common causes of oxidative damage to the skin is exposure to ultraviolet radiation. A formulation containing both tocotrienols and tocopherols was applied to photosensitive individuals before they were subjected to a photoprovocative test. It was notable that a single application was sufficient to endow protection. Moreover, T3 as a natural compound was found to be safe and did not induce any adverse side-effect in these individuals (Pedrelli *et al.*, 2012).

OTHER THERAPEUTIC EFFECTS AND SAFETY OF TOCOTRIENOL SUPPLEMENTATION

Non-alcoholic fatty liver disease (NAFLD) has been reported to be prevalent globally. A team of scientists from the Universiti Sains Malaysia (USM) initiated a study to look at the effects of TRF supplementation on NAFLD patients. TRF supplementation with 400 mg per day over a year showed remarkable improvement in these patients without any worsening of the condition in comparison with the placebo group. Notably, TRF supplementation was also shown to reduce the TC, LDL and TG parameters (Magosso *et al.*, 2013), and was well tolerated by the subjects without any adverse side-effects.

In another study, supplementation with 400 mg TRF daily was found to be tolerable and safe in individuals with metabolic syndrome (Gan *et al.*, 2016). An interesting study conducted on pregnant women supplemented with TRF showed statistically lower blood loss during delivery. This finding dispels the concerns regarding the elevated risk of bleeding following T3 supplementation (Mahdy *et al.*, 2013).

CONCLUSION

Clinical studies carried out with T3 vary in terms of dose, condition studied and population. Nevertheless, many therapeutic effects of T3 have been established and better understood based on the findings from these studies. Being a nutraceutical compound, T3 has been shown to be safe for consumption. The increasing burden of adverse effects with conventional treatments and their skyrocketing cost have shifted attention to the use of natural compounds. Emerging new findings from larger clinical trials may provide the much needed evidence to health care providers and consumers on the beneficial effects of tocotrienols.

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calibration and testing laboratories worldwide. Laboratories accredited to this international standard have demonstrated that they are technically competent and able to produce precise and accurate test and/or calibration data. Accreditation is a voluntary, third party-reviewed process.

As part of the accreditation, a laboratory's quality management system is thoroughly evaluated on a regular basis to ensure continuous technical competence and compliance with ISO/IEC 17025 Standard.

In view of this, the management, record keeping and analysis need to be organised in order to achieve the ATS Laboratory Quality Policy, especially in terms of timeliness and outcome of analysis (*Figure 2*). Therefore, the most important objectives of the laboratory are to ensure that the results of precise and accurate analysis meet the needs and expectations of customers and to be certified according to the international standards. The ATS Laboratory also serves as a reference laboratory for PO analysis when handling discrepant results or in cases of dispute between buyer and seller in the trading of PO. Hence, the ISO/IEC 17025 Standard has been designed to incorporate the requirements of ISO 9001 and is implemented to ensure that the ATS Laboratory complies with the requirements of both international standards.

IMPLEMENTATION OF ISO/ IEC 17025

ISO/IEC 17025 Standard is an international standard which specifies the general requirements for the competence to carry out tests and/or calibrations. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory developed methods. The laboratories that have been successfully accredited with this standard will be internationally certified in terms of management efficiency, competency of technical staff and capability of producing technically valid results. This accreditation is an essential requirement that will endorse the quality of results produced by the laboratory.

ISO/IEC 17025 is based on documented procedures for each activity being performed. Documents containing a systematic working way can be used as a basis for performance improvement, whereas an annual audit process can ensure effectiveness in achieving the quality management system of ISO/IEC 17025. The dedication and commitment given by every personnel of the laboratory have contributed to the successful implementation and maintenance of this quality management system. Through this system, a culture of teamwork has been embedded in the laboratory personnel. Personnel performance improvements are achieved by creating standard operating procedures (SOP), effective control of data, appropriate and adequate resources, and providing training and conducive environment. Methods of analysis, management practices and work flow are documented systematically. These documents are constantly updated and can be used as a reference basis for performance improvements. The laboratory has a Quality Management System and Quality Assurance Plan in which laboratory personnel who is compliant with the system is able to produce accurate and high quality analytical results.

ACCREDITATION PROCESS

AOTD's ATS Laboratory accreditation process is carried out by Standards Malaysia (formerly Department of Standards, Malaysia). The process involves a formal evaluation to assess the ability and competence of the laboratory in compliance with the requirements of ISO/IEC 17025. This will guarantee the methods used and the results obtained are technically valid because the efficiency of the laboratory and competency of personnel are assessed and certified.

The annual Management Review meeting which is part of the requirement of the standard, will ensure that the policy and objectives are in line with MPOB's mission and vision. At this meeting, Technical Manager (TM) or Quality Manager (QM) will present among others, the results of internal audits as they are responsible for providing corrective and preventive actions, participating in cross-check programmes, continuous improvement, quality control activities and personnel training.

Figure 1. The Analytical Testing Services (ATS) Laboratory of Advanced Oleochemical Technology Division (AOTD).

MPOB

QUALITY POLICY OF ANALYTICAL TESTING SERVICES LABORATORY, AOTD, MPOB

It is the established policy of the Analytical Testing Services Laboratory, Advanced Oleochemical Technology Division (ATS Laboratory), of the Malaysian Palm Oil Board (MPOB) to provide the palm oil industry worldwide with accurate, prompt and independent analytical services in accordance with the procedures based on ISO/IEC 17025 requirements

Figure 2. Analytical Testing Services (ATS) Laboratory Quality Policy.


S/N: 0561

STANDARDS MALAYSIA

Certificate of Accreditation

No: SAMM 177 Accredited since: 29 September 1999

This is to certify that

ANALYTICAL TESTING SERVICES LABORATORY
ADVANCED OLEOCHEMICAL TECHNOLOGY DIVISION
MALAYSIAN PALM OIL BOARD
KAJANG, SELANGOR
MALAYSIA

has been granted accreditation in respect of the scope of accreditation described in the schedule, subject to the terms and conditions governing the *Skim Akreditasi Makmal Malaysia* (SAMM), the Laboratory Accreditation Scheme of Malaysia.

Laboratories accredited under SAMM meet the requirements of MS ISO/IEC 17025. This Malaysian Standard is identical with ISO/IEC 17025 published by the International Organization for Standardization (ISO).

(DATUK FADILAH BAHARIN)
Director General
Department of Standards Malaysia

Date of issue: 13 September 2017

Figure 3. The MS ISO/IEC 17025 certificate of Advanced Oleochemical Technology Division (AOTD)'s Analytical Testing Services (ATS) Laboratory.

An Internal Audit is conducted annually by an appointed Internal Assessors from another Division in MPOB to assess the adequacy of management and technical competencies of the laboratory in producing quality results. Meanwhile, the External Audit will be carried out by the External Assessors from Standards Malaysia. It is usually conducted in five stages, namely i) Adequacy Audit, ii) Pre-assessment Audit, iii) Compliance Audit, iv) Surveillance Audit and v) Reassessment Audit. Adequacy Audit is the initial process of a laboratory application for accreditation involving evaluation, compliance records and documentation related to ISO/1EC 17025. Pre-assessment Audit (or audit trial) is held to assess the level of laboratory preparedness prior to the actual audit (*i.e.* compliance audit). Compliance Audit is carried out comprehensively as the details of laboratory management system and technical aspects are inspected to ensure they meet the requirements of ISO/IEC 17025. The laboratory will be awarded an ISO/IEC 17025 accreditation certificate after the External Assessors are satisfied with all the corrective Actions taken during the Compliance Audit. Once accredited, Surveillance Audit will be carried out once every two years, followed by the Reassessment audit in the third year. These audits are carried out to ensure that the requirements of ISO/IEC 17025 are met in order to maintain the accreditation. MPOB's ATS Laboratory is awarded ISO/IEC 17025 accreditation since September 1999 [certificate No. *Skim Akreditasi Makmal Malaysia* (SAMM) 177)] after all the requirements of ISO/IEC 17025 have been complied. Since then, the laboratory has successfully maintained its accreditation until today (*Figure 3*).

CHALLENGES AND PROCESS IMPROVEMENT

As with any other new system implementation, there were several challenges faced by laboratory management. For example, the level of understanding of ISO/IEC 17025 system and its importance differs between the laboratory personnel as they were not used to the implemented procedures. The laboratory also faced budget constraints during the initial implementation of this quality management system. For example, to obtain the ISO/IEC 17025 accreditation, all personnel of the laboratory must undergo a series of training. In addition, calibration of laboratory equipment is compulsory as one of the requirements of the ISO/IEC 17025 system.

In the early stages of implementation, the laboratory's management faced difficulties in changing the attitudes, norms and working habits of laboratory personnel. Moreover, with the new system, they have to adhere strictly to the procedures. There were several actions taken by the QM and TM when addressing the above problems. First, all laboratory personnel were sent to the Scientific and Industrial Research Institute of Malaysia (SIRIM) and Institut Kimia Malaysia (IKM) for quality management system training. Secondly, an annual budget was requested by MPOB's management to carry out the quality management system and maintain the accreditation. As part of process improvement to maintain the competency and efficiency of the Laboratory as well as its personnel, participation in cross-check programmes conducted by an international body (American Oil Chemists Society, AOCS) and national bodies (Department of Chemistry and Sime-Darby) is planned as an annual programme. The cross-check programmes include the AOCS Laboratory Proficiency Programme (participated since 2000), Sime-Darby Inter-laboratory Cross-check Programme (participated since 2001) and *Jabatan Kimia* Malaysia Proficiency Testing Programme (participated since 2003).

The excellent results of the cross-check programmes have proven that the efficiency and competency of the laboratory and its personnel have been greatly improved (*Tables 1, 2* and *3*).

OUTCOME

There is an increase in the number of samples received by the laboratory for analysis, from internal and external clients, local and abroad. This shows that the laboratory has successfully gained the trust of its clients as a reference laboratory for PO analysis. In addition, the laboratory meets the needs of MPOB's Client Charter, which requires MPOB to provide an accurate and prompt analysis

TABLE 1. RESULTS OF THE AMERICAN OIL CHEMISTS SOCIETY (AOCS) LABORATORY PROFICIENCY PROGRAMME

Programme	Result
• AOCS Laboratory Proficiency Programme (2005-2006)	• Honourable Mention (tie) for GC
• AOCS Laboratory Proficiency Programme (2006-2007)	• Fifth place out of 86 international laboratory for *trans* fatty acid test
• AOCS Laboratory Proficiency Programme (2007-2008)	• Honourable Mention for GC test
• AOCS Laboratory Proficiency Programme (2008-2009)	• Approved Chemist Status
• AOCS Laboratory Proficiency Programme (2009-2010)	• Approved Chemist Status
• AOCS Laboratory Proficiency Programme (2010-2011)	• Approved Chemist Status
• AOCS Laboratory Proficiency Programme (2011-2012)	• Honourable Mention for GC test
• AOCS Laboratory Proficiency Programme (2012-2013)	• First place out of 86 international laboratory for *trans* fatty acid test
• AOCS Laboratory Proficiency Programme (2013-2014)	• Honourable Mention for GC test
• AOCS Laboratory Proficiency Programme (2014-2015)	• First place for GC and Honourable Mention for palm oil tests
• AOCS Laboratory Proficiency Programme (2015-2016)	• Honourable Mention for GC and *trans* fatty acid tests

TABLE 2. *JABATAN KIMIA* MALAYSIA PROFICIENCY TESTING PROGRAMME

Year	IV	FFA (%)	SMP (%)
2003	Satisfactory	Satisfactory	Satisfactory
2004	Not satisfactory	Satisfactory	Satisfactory
2005	Note: No cross-check programme in 2005		
2006	Satisfactory	Questionable	Satisfactory
2007	Satisfactory	Satisfactory	Satisfactory
2008	Not satisfactory	Satisfactory	Satisfactory
2009	Satisfactory	Satisfactory	Satisfactory
2010	Questionable	Satisfactory	Satisfactory
2011	Satisfactory	Satisfactory	Satisfactory
2012	Satisfactory	Satisfactory	Satisfactory
2013	Note: Did not participate in the PT programme due to moving to the new building		
2014	Satisfactory	Satisfactory	Satisfactory
2015	Satisfactory	Satisfactory	Satisfactory
2016	Satisfactory	Satisfactory	Satisfactory

Note: IV – iodine value. FFA – free fatty acid. SMP – slip melting point.
The interpretation of the results on z-score ($|z|$) is given below:
• Satisfactory means $|z| \leq 2$.
• Questionable means $2 < |z| \leq 3$.
• Not satisfactory means $|z| \geq 3$.

TABLE 3. SIME DARBY INTER-LABORATORY CROSS-CHECK PROGRAMME

Series	Parameter and Performance
2001	1. Iron, copper, UV totox, FFA - good 2. Carotene - very good 3. DOBI - acceptable
2002	Note: No cross-check programme in 2002
2003	UV totox, carotene, FFA, DOBI – very good
2004	1. DOBI, UV totox , FFA, Cu & Fe - very good 2. Carotene - acceptable
2005	DOBI, carotene, UV totox, FFA, Cu & Fe- very good
2006	DOBI, carotene, UV totox, Cu, Fe - very good
2007	1. UV totox, Cu, FFA, DOBI, Fe - very good 2. Carotene - to be repeated
2008	1. UV totox, DOBI, carotene - good 2. Iron & coper - not good
2009	1. UV totox, DOBI, carotene, copper - good 2. FFA - satisfactory
2010	UV totox, DOBI, carotene, FFA - good Overall performance ranking 4/7 laboratory
2011	Copper, iron, UV totox, DOBI, carotene, FFA - laboratory (rank 1/9 laboratory) Overall performance ranking 1/7 laboratory
2012	FFA, VM, impurities, DOBI - good (samples 1 & 3) Overall performance ranking 4/12 laboratory
2013	FFA, VM, impurities, DOBI - satisfactory Overall performance ranking 10/12 laboratory
2014	FFA, VM, impurities, DOBI, GFAAS (Cu), GC (lauric acid – C12) - satisfactory Overall performance ranking 8/12 laboratory
2015	FFA, PV, VM, dirts, DOBI, UV, carotene, IV, AAS (Fe), GFAAS (Cu) GC (lauric acid – C12) - satisfactory (rank 8/14 laboratory) Overall performance ranking 8/12 laboratory
2016	FFA, PV, VM, dirts, DOBI, UV, carotene, IV, AAS (Fe), GFAAS (Cu) GC (lauric acid – C12) – satisfactory Overall performance ranking 9/16 laboratory
2017	FFA, PV, VM, dirts, DOBI, UV, carotene, IV, AAS (Fe), GFAAS (Cu) GC (lauric acid – C12) Overall performance ranking 15/17 laboratory

Note: The interpretation of the results on z-score (l z l) is given below:
Year 2001-2008:
- Very good means S.D. < 1
- Good means S.D. < 2
- Acceptable means 2 > S.D. > 2.8
- Unsatisfactory S.D. > 2.8

Year 2009-2017:
- Good means l z l ≤ 1
- Satisfactory means 1 < l z l ≤ 2
- Questionable means 2 < l z l≤ 3
- Outlier means l z l ≥ 3

TABLE 4. COMPARISON OF THE TIME TAKEN TO ANALYSE SAMPLES BEFORE AND AFTER IMPLEMENTATION OF ISO/IEC 17025 IN ANALYTICAL TESTING SERVICES (ATS) LABORATORY

Year		Percentage of sample being analysed					
		1 day (%)	3 days (%)	7 days (%)	2 weeks (%)	4 weeks (%)	> 4 weeks (%)
1998	(before)	15	16.6	14.4	40.5	11.1	2.4
2008	(10 years after)	21	21	32.3	25.7	-	-
2017	(19 years after)	30	32	28	10	-	-

to clients within two weeks. The comparative statistics in *Table 4* shows the laboratory's success in improving the number of days taken for sample analysis in order to meet the client charter before and after the implementation of ISO/IEC 17025 in the laboratory.

In addition, ATS Laboratory provides analytical services to researchers and Licensing and Enforcement (L&E) Division in MPOB (*Figure 4*). The availability of the AOTD's accredited analytical services enables MPOB's researchers to save on analysis cost by using in-house services rather than using external services from other independent laboratories.

EFFECTIVENESS OF IMPLEMENTATION OF ISO/IEC 17025 SYSTEM

The quality management system ISO/IEC 17025 has helped to enhance the data processing capabilities, produce accurate results, avoid wastage from repetition of work and increase the productivity. Furthermore, it also provides a number of benefits such as reduction in operating costs, time savings, work improvement, increase the level of customer satisfaction and reliability of analytical results. The operating cost is reduced because less corrective actions need to be taken in the event of an error. This subconsciously creates a consistent way of working and meets the principle of 'doing it right the first time', which indirectly saves the use of chemicals. By complying the quality policy, the time required to perform repeated tests could be reduced by 30%. This is achieved through proper planning before performing the analysis, as it can avoid waste of time and trains laboratory personnel to be more efficient in their work.

The ATS Laboratory is able to fulfill MPOB's and customer's requirements in producing accurate and reliable analysis results. This allows the laboratory to identify and eliminate recurring problems. These

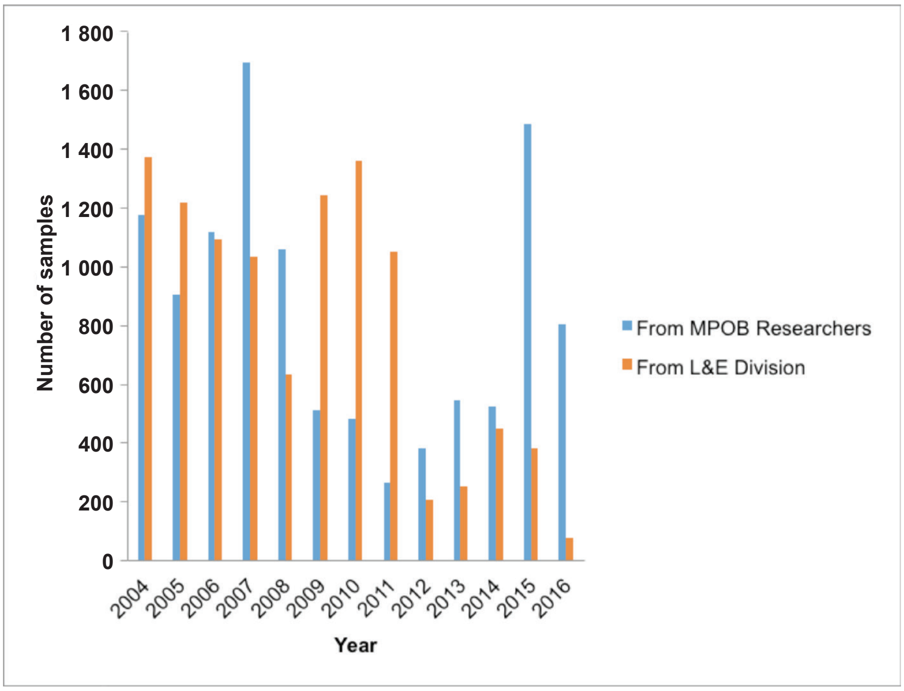

Figure 4. The number of samples received from researchers and Licensing and Enforcement Division, in MPOB from 2004 to 2016.

are done through the identification of root cause and the implementation of corrective actions. Improved reliability of data analysis is achieved through data validation and verification processes. The implementation of this quality management system allows the laboratory to be certified and accredited.

RECOGNITION

Skim Akreditasi Makmal Malaysia (SAMM) logo embedded in the ISO/IEC 17025 certificate represents the industry's confidence in the results of analysis issued by the laboratory. In addition to the local PO and oleochemical industry, the ATS Laboratory also received samples from overseas companies such as Yemen Co. for ghee and soap industry (Yemen), PT Musim Mas (Indonesia), K K Kingston Ltd (Papua New Guinea) and The Natural Palm Oil (Chumporn) Co. Ltd from Thailand, to name a few. This proves that the accredited ATS Laboratory is being accepted both nationally and internationally. The Laboratory has received several awards and achievements, such as the 'AOCS Approved Chemist Status' and 'AOCS Honourable Mention', which are considered to be the highest level of AOCS awards, IKM Excellence Award, IKM Silver Award, IKM Gold Award, as well as seven times winner of the MPOB's Best Laboratory award. These achievements and awards have built up the trust and reputation of the ATS Laboratory for the palm oil analysis.

CONCLUSION

By implementing the ISO/IEC 17025 quality management system, AOTD's ATS Laboratory's reputation as a reference laboratory for analysis of PO is well sought after as it is highly preferred in research activities and services especially in the eyes of the industry and clients. All operations, facilities, laboratory procedures and human resources are assessed independently in accordance with international standards. This system allows the management to effectively assess the strengths and weaknesses of the laboratory and its personnel so that the management can efficiently improve it. The existence of the quality management system ISO/IEC 17025 in ATS Laboratory has allowed AOTD to be recognised as a centre spearheading the oleochemicals downstream R&D activities for Malaysia as aspired by the Malaysian government under the Economic Transformation Programme for the PO industry.

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