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MALAYSIAN PALM OIL PRICES STABLED BUT EXPORTS DECREASED

Malaysian palm oil prices stabilised at RM 1533.67 per tonne during the first six months of this year. This was much higher than those of last year and of 1993 (RM 1283.54 and RM 890.25 respectively). The high price of palm oil had partly contributed to the decline in exports from Malaysia to 3.126 million tonnes during the first half of the year from 3.251 million tonnes during the same period last year.

HANDLING, STORAGE AND TRANSPORTATION OF FRESH FRUIT BUNCHES AND PALM OIL PRODUCTS

By Dr Chong Chiew Let

Introduction

Palm oil is well known to be a semi-solid oil or fat at ambient temperature. It is for this reason that it can be processed into a liquid fraction (olein) and a solid fraction (stearin), thus catering to the market for liquid oils as well as the market for solid fats. Because of the semi-solid nature of palm oil, it has to be stored and handled differently from completely liquid oils in order to preserve its quality or to minimize any deterioration in quality.

Malaysia produced slightly more than seven million tonnes of palm oil in 1994, the bulk of which was exported in the refined form. In the crude state, the oil is protected by natural, indigenous components which are either removed or reduced in quantity during the refining process. This is partially compensated for by the removal of other deleterious materials during the refining process. During export there is a lot of handling and processes which may include heating, so that extra care must be observed in order to preserve the quality of the oil as much as possible and so avoid negating the efforts put in by the refiners to produce good products.

Handling of Fresh Fruit Bunches

It is a well accepted fact that good refined oils with good keeping quality can only be produced from good quality crude oils. Accordingly, the quality chain in respect of storage and handling starts from the harvesting process. During harvesting and the subsequent transportation of fresh fruit bunches to the mill, they should be subjected to a minimum of handling steps in order to reduce the amount of fruit damage. Increasing the number of handling steps increases the chances of fruit damage, in addition to being less economical. Where damage to fruits is inevitable as a result of handling the bunches, care should be exercised to reduce it as much as possible. Workers in both the plantation and milling sectors should be instructed on why this is important in relation to subsequent oil quality. Such instruction constitutes the training part of a quality assurance system and will also give the workers a sense of purpose since they will know why there is a need to prevent bunch and fruit damage. Because the rate of quality deterioration is temperature dependent, it also helps to store the fresh fruit bunches in the shade rather than under direct sunlight, wherever and whenever possible.

Milling Practices

At the mill, it is important to minimize fruit damage further before sterilization, *i.e.* at the ramp and during loading of the sterilization cages. The fruits should be sterilized as soon as possible after receipt in order to inactivate the biological factors responsible for quality deterioration.

During the milling process, millers should strive to produce high quality crude oil as the norm rather than for premiums. This could be achieved with the present milling technology with some precautions and common sense practices. Oil should be handled with care without exposure to unnecessarily high temperatures. Pumps should be well maintained in order to prevent aeration from worn-out pump components. Over-top loading of oil into tankers should be carried out with the aid of a retractable telescopic arm. These are some examples of how simple and inexpensive innovations and common sense could help to improve oil quality during processing and handling. Other measures could be identified by means of quality audits on the milling process, with management commitment.

Mills should ensure that there is sufficient storage tank space to enable tanks to be cleaned at least once a year. More frequent cleaning

In general, the principles which govern the handling, storage and transportation of palm oil and palm oil products from the mill to refinery, bulking installation or ship are essentially the same, albeit with minor differences, dictated by the requirements of the individual process in each of these places. The handling, storage and transportation practices for the refinery are largely the same as those for the mills.

is recommended as this would minimize the build-up of the undesirable 'foots' layer at the bottom of the tank. A hot water system is preferable to a steam system for tank heating as it avoids superheating of the oil around the steam coils. Storage tanks should be equipped with temperature controllers and these should be well maintained for effectiveness. Recommended temperatures, heating rate, procedures and other relevent details for storage and handling of palm oil and palm oil products have been well documented (Leong *et al*, 1982; Berger, 1983, and PORAM Guide). Suitable tank coatings are also recommended as they prevent oil-metal contact during storage, as well as facilitating tank cleaning.

In general, road tankers used for the transportation of crude oil to the mills and from the refineries to the bulking installations are dedicated to the carriage of palm oil products, hence contamination from external sources is rare. Like storage tanks, road tankers should be cleaned prior to loading in order to preserve oil quality even if the tanker is dedicated to the carriage of a single product type; cleaning is essential if the product type to be carried is changed, in order to prevent cross contamination.

Refinery Practices

In general, the principles which govern the handling, storage and transportation of palm oil and palm oil products from the mill to refinery, bulking installation or ship are essentially the same, albeit with minor differences, dictated by the requirements of the individual process in each of these places. The handling, storage and transportation practices for the refinery are largely the same as those for the mills.

In addition, if the pretreatment process or part of it could be carried out under partial vacuum, this would contribute towards the preservation of oil quality. Deterioration in the quality of palm oil and palm oil products through either oxidation or hydrolysis is akin to the fire triangle in fire safety. Oil (a heat source) and oxygen (or water) must be present simultaneously before the oxidation (or hydrolysis) reaction can occur at a significant rate. In the absence of any of these factors the reaction will not occur. Applied to handling procedures, this implies the prevention of ingress of moisture (hydration) or diffusion of oxygen into the oil (aeration) and overheating of the oil. If this underlying principle is adhered to, the deterioration of oil quality will be minimal.

Bulking Installation Practices

As mentioned above, the same general principles applying to the mill and refinery are applicable to the bulking installation.

A useful practice in the handling, storage and transportation of palm oil and palm oil products, including oleochemicals, is nitrogen sparging and/or blanketing. Nitrogen sparging and blanketing facilities are easily available in most bulking installations and in more quality-conscious refineries. It is now possible to protect a product fully, right from the production point through to the end-user overseas at a small cost to the end-user. Experience with past shipments under such conditions has shown that the quality of the oil is maintained during transportation and that it can be used directly by the buyer for his purposes without further polishing or processing.

Latest Developments Affecting Handling and Surveying Practices in Malaysia

In order to standardize surveying practices on palm oil products, the Palm Oil

Registration and Licensing Authority (PORLA), working in conjuction with the surveying industry and with technical support from PORIM, has issued the PORLA Standard Surveying Guide for use by the industry.

In order to upgrade the professionalism of the palm oil products surveying sector, PORIM organized the first Ship/Shore Surveyors Course; a second course was held in conjunction with the Maritime Academy of Malaysia (ALAM). Subsequent courses were held jointly by PORLA and PORIM. The aim of these courses is to provide the surveyor with the knowledge required in his work so that he can carry out his role in a more professional manner with a proper understanding of the steps needed in the handling and transportation of palm-based products. The courses are open to personnel from the surveying, bulking and refining sectors of the palm oil industry.

To ensure professionalism, surveyors are required to pass an examination on oil palm surveying conducted by PORLA with the technical support of PORIM. Successful candidates in this examination are registered by PORLA as qualified palm oil products surveyors. With effect from 1 November 1995, all surveys on palm oil product shipments can be conducted and certified by these registered surveyors. In addition, surveyors in Malaysia are bound by a set of 'Conditions and Restrictions' and a 'Code of Ethics' issued by PORLA as conditions for their licences.

With the introduction of ISO 9004, '2 Guidelines on ISO 9000 for Service-Oriented Industry', certification to ISO 9000 standards is the obvious step forward for both the surveying and bulking sectors of the palm oil industry. To date, two bulking installations have been certified to the ISO 9002 Standard while some surveying companies are in various stages of setting up quality assurance systems to the same standard; other sectors of the industry are also moving in the same direction.

References

- Berger, K.G (Editor); Recommended Practices for Storage and Transport of Edible Oils and Fats, A PORIM Guide; July 1983.
- Leong, W.L. and Berger, K.G.; Storage, Handling and Transportation of Palm Oil Products, PORIM Technology, Number 7, August 1982.
- PORAM Guidebook on Processed Palm Oil Storage, Transportation, Sampling and Survey Guide. ✪

AQUACULTURE – AN EMERGING MARKET FOR PALM OIL

Contributed by Dr B A Elias and T P Pantzaris

Aquaculture is a profitable industry in which aquatic animals are farmed for food; it is currently expanding at over 10% per annum, which is much higher than the rate of growth in the farming of many other domesticated animals. The growing popularity of aquaculture is due partly to its guarantee that the sea or fresh-water foods produced are free from the industrial pollutants often contaminating the seas and rivers.

Protein is the most important and scarcest basic food component for mankind. Sea foods have been prized since time immemorial, but until recently the fishing industry relied mainly on the primitive method of continued harvesting of the world's seas and oceans. With increasing world population and especially with the introduction of ever more efficient methods of harvesting the seas on a huge scale, fish stocks have been depleted to critical levels, and already we are witnessing international disputes on fishing rights involving major developed countries. The rapidly growing trend towards healthy eating, which encourages a pattern of consumption with a switch from meat to fish in developed countries, will put further pressure on the dwindling fish population. This can only be offset by aquaculture, which will lead to increased demand for fish feeds.

In aquaculture aquatic animals are reared in a captive environment using manufactured feeds containing proteins, carbohydrates and fats in appropriate proportions. By contrast with caged poultry or calves, for example, aquacultured fish have the attraction that they are 'free-range'. The annual global output of farmed fish already amounts to 16 million tonnes, worth over US$20 billion and representing 20% of all the fish bought for food.

Until recently, the most suitable oil for inclusion in fish feeds was considered to be fish oil, but now studies are showing that such oil is only necessary in sufficient amounts to provide the essential fatty acids, at about 1% energy; the balance can be any other major oil.

Fish feeds are formulated to contain up to 30% fat and too much of it is likely to result in rapid deterioration owing to rancidity. As a result tallow, lard, soyabean, rapeseed and palm oil are increasingly being used on a least cost basis. Crude palm oil may have significant major advantages because of its content of beta-carotene and tocotrienols : Vitamin E is known to contribute to higher growth rate and active spawning. The higher palmitic to stearic acid ratio of palm oil leads to better digestibility. Crude palm stearin can also be used. There is the apparent problem that the melting point of the fat has to be below 38°C, but since in practice some fish oil is a necessary component, the melting point of the blend can easily be brought down to this level. Palm oil and its products clearly have good prospects in aquaculture and all aspects should be further explored for the benefit of the palm oil industry. ✪

COMMON PRACTICES TO MAINTAIN THE QUALITY OF PALM OIL AND ITS PRODUCTS QUALITY

Contributed by Dr Leong Wan Leong

Oxidation, the main reaction which causes deterioration in the quality of oils in general, is related to the dissolved oxygen content (DOC). Reducing the DOC in palm oil products will help in reducing oxidation and hence in maintaining quality. Protection of oil from oxidation during shipping can be achieved by :

- **nitrogen blanketing**
- **nitrogen sparging to reduce DOC**

Nitrogen Blanketing

During storage in shore or ship tanks exposure to air can be minimized by the use of inert-gas blanketing , *e.g.* nitrogen blanketing, which is cheap. Reducing the concentration of oxygen using nitrogen in the tank head-space reduces the solubility of oxygen in the oil, thus causing oxygen to migrate out of the oil into the head-space. Blanketing thus reduces exposure to oxygen as well as providing a means of oxygen desorption. Floating lids on the surface of an oil also help to reduce exposure to atmospheric oxygen.

Nitrogen Sparging

De-aeration and the removal of dissolved oxygen in the oil can be done more effectively by pipeline sparging with nitrogen during pumping, such as during loading into the ship's tanks or discharging. Oxygen desorption by sparging has the advantage of breaking up the nitrogen into tiny bubbles within the oil itself, thus increasing the surface area of the oil in contact with nitrogen and bringing the nitrogen gas in closer contact with the oil. There is migration of these tiny bubbles within the oil itself, thus increasing the surface area of the oil in contact with nitrogen. The slow migration of these tiny bubbles upward through the oil finally removes atmospheric oxygen.

Use of Chemical Antioxidants

Direct protection against oxidation can be obtained by the use of chemical antioxidants. Some of the most common are Buthyl hydroxyanisole (BHA), Buthyl hydroxy toluene (BHT) and Tertiary buthyl hydroxy Quinone (TBHQ). The application of these substances is restricted by food regulations which vary between countries. The concentrations used range from 100 to 200 ppm. The use of citric acid as a synergist is a common practice; it chelates or inactivates pro-oxidant metals. Where legally permitted, the use of TBHQ or a TBHQ/citric acid system is recommended; these have proven to be effective. It is important to ensure complete dispersion and dissolution of antioxidants in the oil, which can be achieved either by dissolving them in hot oil (60°C) or in a solvent miscible with oil, before addition. Where possible a dosing pump should be used and the antioxidant solution should be added to loading or unloading pipelines. Complete mixing of the antioxidant can be ensured by the incorporation of a static mixer in the loading line. ✪

A NEW FAMILY OF LOW-CALORIE FATS

Contributed by Dr B A Elias and T P Pantzaris.

A new family of low-calorie fats is about to be marketed by the international Pfizer Foods Science Group under licence from Nabisco Foods Group, as was recently reported in International Food M&T.

The new family of fats is called 'Salatrim', an abbreviation of Short and Long Chain Acid and Triglyceride Molecules. It is claimed to be derived from fully natural ingredients and to provide only 5 calories per gram, compared with 9 calories for traditional fats. It is also claimed that the new fats could be used in a wide variety of processed foods, but the first uses are expected to be in baking, confectionery and coatings (substitute chocolate).

Salatrim has been subjected to independent tests for safety and palatability and has recently been awarded Generally Recognised As Safe (GRAS) status by the United States Food and Drug Administration (FDA).

Dr Dave Trecker, Senior Vice President for R&D at Pfizers, explained that the key to Salatrim's reduced calorie content lay in the combined use of inherently low-calorie, short chain fatty acids, and long-chain fatty acids (*e.g.* stearic) which the body cannot fully absorb, resulting in a 45% calorie reduction.

Salatrim was developed by the Nabisco Food Group, which claims that of its total 1993 sales, 30% were from products which did not exist five years ago. The company is a subsidiary of the giant RJR Nabisco, one of the world's major food companies, with annual sales of US$5.9 billion.

Note :

The claim that stearic acid has significantly lower digestibility than most other fatty acids may be worth looking into afresh. In many countries of the world, palm oil competes with stearic rich fats and most countries want fats of high digestibility. ✪

PLACEMENT OF FOOD LABELS

On 5 April, the Food and Drug Administration issued a final rule (60 FR 17202) to amend food labelling regulations to provide increased flexibility in the placement of nutrition labels on packaged foods. In situations where the principal display and information panels cannot accommodate all the required labelling information, and the package has a total surface area available to bear labelling of greater than 40 square inches, the amendment allows the label to be placed on any panel that can be readily seen by the consumer. The new rule becomes effective on 5 May, 1995. ✪

HEALTHY PEOPLE FOR THE YEAR 2000

Half way through the campaign to improve the health of Americans by the year 2000, researchers from the US Public Health Service have noted that Americans are smoking less and avoiding fatty foods. However, there are still too many 'couch potatoes'. Fewer Americans suffer from heart attacks or strokes, perhaps as a result of lower cholesterol levels. While the average life expectancy for Americans is now 75.8 years, researchers noted that the average period without health problems is actually 64 years. While more people exercise regularly and choose a low-fat diet, there has been no change in the number of people who never exercise. ✪

FATTY ACIDS AND GLYCERINE FROM PALM AND LAURIC OILS : A MALAYSIAN EXPERIENCE

Contributed by
R.S. Murthy, Natural Oleochemicals Sdn. Bhd., Johor. Malaysia.

Palm oil, its stearin fraction and lauric oils such as palm kernel and coconut oils form excellent raw materials for production of fatty acids and glycerine. The oils are split continuously into fatty acids and glycerol in a stainless steel column at high pressure, 55-60 bar, and high temperature, 250-260°C, with the water fed from the top countercurrent to the oil. The crude fatty acids are fractionated to individual fatty acid with carbon chain lengths in the range of C8 and C18. The purity and heat stability of the fatty acids are very important for their application in various fields. Hydrogenation of the fatty acids as either crude acids or individual unsaturated fatty acid helps to produce saturated acids with very low iodine value and high heat stability. A loop reactor found to be very efficient in achieving the desired degree of hydrogenation, and vice versa, was studied comparatively to produce high-quality fatty aicds. Glycerine, a by-product in the fatty acid industry, is refined by using the distillation process and subsequent carbon treatment for producing USP/BP grade glycerine of high purity and excellent stability. ✪

THE POTENTIAL USES OF TOCOTRIENOLS FOUND IN PALM OIL

by Dr. N. Chandrasekharan

Tocopherols are the common form of vitamin E found in vegetable oils and animal products, but tocotrienols, the analogues of vitamin E are found in high concentration in palm oil. Palm oil has more tocotrienols than tocopherols and both of them have anti-oxidant potential.

A recent paper by Khor *et al.* from the University of Malaya in Nutrition Research reports on some exciting findings relating the effects of tocotrienols on the enzyme HMG-CoA reductase, which is the key regulatory enzyme for cholesterol synthesis in the liver. Any factor that

THE ROLE OF ANTIOXIDANTS IN LIMITING THE PROGRESSION OF HIV INFECTIONS

Contributed by Dr Chandrasekharan

It has been estimated that approximately 30-40 million people around the world will be infected with HIV by the year 2000 and progress to AIDS usually occurs over a period of 8-10 years. Certain factors may modify the course of HIV infection.

Free Radicals and Immune Function

Free radicals may be a potent inducer of viral activation in addition to causing DNA damage, leading to immune suppression. Viral and opportunistic infection lead to increased free radical generation, which could contribute to a steady decline in immune function.

Deficiencies of certain micro-nutrients, including anti-oxidants, may enhance immune deficits. In addition, lowered levels of β-carotene and vitamin E have been reported in patients infected with HIV.

Anti-Oxidant Therapy

A large body of data from basic research and epidemiological evidence supports the notion that an intake of vitamin E above that required to prevent deficiency may be advantageous in the prevention of degenerative diseases.

The ability of certain anti-oxidants to enhance cellular immune response has been receiving increased attention. Nutrient supplementation may improve host resistance to HIV infection. Data from animal and human studies have demonstrated that vitamin E in large doses improves immune response and resistance to infections. Positive effects of β-carotene on immune function have also been demonstrated recently.

Results of preliminary animal and human studies have shown potential benefits of vitamin E, β-carotene and other nutrients in delaying progression of HIV infection to clinical AIDS and in decreasing symptoms associated with HIV infection and AIDS. These nutrients may also be of benefit in combined therapy with anti-viral agents.

Vitamin E is a major anti-oxidant in biological systems and is present in significant amounts in palm oil (~1172 ppm) both as tocotrienols and tocopherols. In addition, palm oil is a rich source of β-carotene (~600 ppm). There are many important functions for vitamin E and β-carotene in addition to their potential use as antioxidants to improve immune function. ✪

affects the activity of this enzyme would eventually affect the cholesterol metabolism in the body. The results show that tocotrienols inhibit liver HMG-CoA reductase activity in the guinea pig and the inhibitory effect is dose dependent, with strongest inhibitory activity at low dosage and very little effect at high dosage. It is pertinent to note that somewhat similar results had been obtained by Qureshi *et al.* in the US while studying the effect of tocotrienols from barley on HMG-CoA reductase in the chicken.

These findings have considerable implications and if confirmed and extended would offer another treatment modality for hypercholesterolemia. In the management of hypercholesterolemia, when non-pharmacological measures are inadequate or when the hypercholesterolemia is severe, HMG-CoA inhibitors like the 'STATINS' are highly effective, especially when LDL-C is the predominant disorder. These HMG-CoA reductase inhibitors have also been reported to reverse the progression of carotid atherosclerosis in man (Lancet 94).

Anti-oxidants can also slow the atherogenic process in several experimental models - probably by preventing the oxidative modification of the LDL a pre-requisite for atherogenesis (Lancet 95). A clinical trial with 'palmvitee' in the United States has shown encouraging results in this respect.

These findings suggest that we have in palm oil the minor constituent - tocotrienols with anti-oxidant potential as well as actions resembling that of the 'STATINS'. Further work in this area would be very rewarding. ✪

References :
Nutrition Research 1995; 15: 537-543
Lancet 1994; 344: 1283-1389
Lancet 1995; 346: 36-38

The Arrest and Regression of Atherosclerosis

Contributed by Dr. Chandrasekharan

Atherosclerosis is characterized by the deposition of fatty substances, principally esterified cholesterol and subsequent fibrosis, primarily in the intima and media of arteries. This results initially in plaque deposition on the endothelial surface and eventually in degenerative changes in the arterial wall. Over time, narrowing of the lumen of blood vessels occurs with ultimate occlusion of the blood flow to the organ or part supplied by the affected artery. Occlusion of the coronary arteries leads to 'heart attack' or myocardial infarction. Occlusion of the cerebral arteries or narrowing of the carotid arteries leads to 'stroke' or cerebrovascular disease. Atherosclerosis represents a spectrum of pathophysiology and a variety of clinical manifestations, and hypercholesterolemia is only one of the causative or contributory factors in the development and progression of atherosclerosis. However, a real and finite relation between the two exists.

Various treatments have been undertaken in the form of dietary manipulations, drugs, lifestyle changes etc. to arrest or induce regression of atherosclerosis with varying degrees of success. Strict adherence to a low fat, low cholesterol diet has been shown to reduce cholesterol levels. Specially formulated Total Parental Nutrient (TPN) solutions have been documented to bring about regression of coronary artery atherosclerosis. One of the problems is the availability of suitable techniques that can monitor the arrest or regression of atherosclerosis precisely.

Regression of atherosclerosis induced by Palmvitee

In a randomized double blind study conducted by Dr. M.L. Bierenbaum of the Jordan Heart Research Foundation in the United States, the effects of Palmvitee (PV) a tocotrienol and tocopherol enriched fraction of palm oil, on serum lipids, fatty acid peroxides, platelet agrregation and carotid artery stenosis was investigated in fifty subjects with cerebro-vascular disease over a period of one year. Using bilateral doppler ultrasonography, it was observed that 30% of the subjects on 'Palmvitee' showed evidence of regression of carotidarterial stenosis, while 40% of the subjects on the 'Placebo' exhibited marked progression of carotid stenosis due to atherosclerosis. There was also a reduction in the serum oxidation products including those of lipid peroxidation, in those given Palmvitee.

The regression of atherosclerosis brought about by Palmvitee is something exciting. The possible mechanism by which this was brought about may include its role as an anti oxidant. The "lipid oxidation hypothesis" states that the oxidative modification of LDL (or other lipoproteins) is important and possibly obligatory in the pathogenesis of the atherosclerotic lesion. A corollary is that inhibiting the oxidation of the LDL will decrease or prevent atherosclerosis and its clinical sequelae. Palmvitee may contribute to the lipophilic antioxidant content of LDL particles and protect it.

Whether these benefits would also extend to the coronary arteries would be of great interest. It will be necessary to use more sophisticated procedures like repeat angiography for monitoring changes in either the progression/regression of atherosclerosis. This is certainly an area for further investigation, as it offers another modality for the management of atherosclerosis and its sequelae and can also be very rewarding. ✪

ANNOUNCEMENT

1996 PORIM INTERNATIONAL PALM OIL CONGRESS "COMPETITIVENESS FOR THE 21ST CENTURY"

23 - 28 September 1996, Istana Hotel
Kuala Lumpur, Malaysia.

The oil palm industry continues to be a dynamic industry in the oils and fats world. Its dynamism is reflected in its growth for the last ten years which has seen planted areas and production increasing tremendously. This is possible because of the energetic contribution and hardwork of members of the industry and also because the industry is supported by comprehensive research and development activities both by national organizations and private bodies around the globe. New knowledge and updated information are churned out by these R&D organizations and these knowledge and information will help to sustain the competitiveness of the industry globally. At the same time the industry has been very conscious about quality even before the ISO 9000 came into the picture. The Congress will further highlight works that have been continuing in sustaining and promoting quality throughout the industry.

Objectives

- To update on the latest R&D findings on various aspects of the oil palm and its products;
- To identify economics, marketing and business opportunities around the globe;
- To highlight quality assurance and maintenance efforts of the oil palm industry;
- To strategize and consolidate the role of the industry vis-a-vis other oilseed crops in the 21st Century;

The 1996 PIPOC will comprise two separate conferences i.e.

A). Agriculture Conference

B). Chemistry, Technology and Nutrition Conference

Two satellite conferences will be held following PIPOC 1996.
These are :-

- ISOPA Oil Palm Agronomy Conference (27-28 September 1996) which is being organized by the International Soceity of Palm Oil Agromony.
- ISOPB Oil Palm Breeding Conference (27 - 28 September 1996 which is being organized by the International Society of Oil Palm Breeders.

In addition, 'Evening workshops' will be held on selected priority issues of global interest.

PNMB, K.L.