External Benefits of Environmental Regulation: Resource Recovery and the Utilisation of Effluents

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Summary

Since 1977, stringent environmental regulation has been progressively imposed on Malaysia's most polluting industry, the palm oil mills. The impact of the regulation on international trade and producer welfare has been quite small compared to the relative benefits to society in terms of changes in the levels of dissolved oxygen in the industrial effluents. External benefits from pollution abatement have been derived. This paper presents a preliminary evaluation of the derived benefits which have a long-term potential of recycling valuable resources while maintaining competitiveness in the international palm oil trade.

Introduction

The oil palm is one of the most versatile oil seed crops grown in the tropical world. Introduced into Malaysia in 1911, its cultivation has today expanded to more than 1.9 million ha, displacing rubber as the premier agricultural crop in the country. In 1989, Malaysia produced about 6.05 million t of palm oil contributing about 10 percent of the nation's export earnings. Malaysia also accounts for about 80 percent of the net world trade of oils and fats, which gives this country the distinction of not only being the leading exporter of palm oil, but also of being the largest single exporter of oils and fats in the world. The palm oil industry remains the third largest export earner of the country, after petroleum (including gas) and timber and its products. It contributed about 7.1 percent to the country's GDP in 1989. The industry also provides a source of livelihood to about 200,000 rural families in Government land schemes and private small-holdings, and employment opportunities to some 80,000 agricultural workers in estates. Employment opportunities are also created in the supporting industries, in trading, palm oil milling, processing and manufacturing sectors.

Along with this success, problems of waste disposal emerged with over 260 palm oil mills operating in the country. Wastes were dumped untreated into rivers. Palm oil mill effluent (POME), which is mainly organic, uses up oxygen in the rivers during decomposition when it is discharged untreated. The depletion of the oxygen level in rivers leads to anaerobic conditions and the release of noxious gases, particularly hydrogen sulphide. Thus, the natural ecology of the rivers is destroyed.

To relieve the problems of the indiscriminate discharge of such a large volume of effluents, the Malaysian Government passed the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulation in 1977. Under this regulation palm oil mills were required to treat their effluents prior to discharging them into streams and rivers. A set of regulatory standards for the POME was...
established by the Department of Environment (DOE) to be complied with, and reviewed in stages, beginning 1st July, 1978.

Research was also intensified to find the solution to the problem. As the waste is unique to this region, the industry had to rely entirely on local expertise and it proved equal to the task. Various efficient treatment technologies for the palm oil mill effluents were developed and adopted by the Malaysian palm oil mills. The treatment systems were able to reduce most of the pollution control parameters to an acceptable level for disposal in water courses and by land application. Through research and development, beneficial uses for treated POME have been found. POME has tremendous potential for conversion into such useful by-products as animal feed and fertilizer, as well as being a source of energy. Over the years, it has been demonstrated that substantial cost savings and revenue have been generated by utilising the POME and the by-products from the mills and POME treatment plants.

**Crude Palm Oil Production Technology and Effluent Generation**

There were 261 palm oil mills operating in 1990, with a combined capacity of 9,695 t of raw materials, *i.e.* fresh fruit bunches (FFB) per hour. The palm oil milling process is more or less standard for all the mills. Palm oil comes from the mesocarp of the fruit of the oil palm. FFB’s are usually harvested from the palms which are grown in plantations or small-holdings and delivered to the mills for processing. Fig.1 shows