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ABSTRACT

The most application of UV curing of surface coating in Indonesia are on fancy plywood, furniture and wood flooring industry. Other application are on papers, printing ink / labelling, printed circuit board/ PCB and dental materials. Although the quality of EB-curing is much better than others curing technology such as UV and catalyst, at present application of EB-curing coating is still in a pilot - plant scale due to the high cost of production. Limited number of application of EB curing by using low energy electron beam machine are on wood panels, ceramics and marbles. Due to the monetary crisis that hit Indonesia since mid - 1997, the export of wood based products reduced to minus 12%, the GDP reduced to minus 13 % and the domestic market reduced up to 40% in 1998. The monetary crisis has improved slightly since June 1999. This paper describes the market and the problem faced by the largest user of radiation curing systems such as the secondary process plywood, furniture and paper industries.

1. INTRODUCTION

Sixty percent of the tropical rain forest in South East Asia that is equal to 10% of the world's total area are found in Indonesia. The main products of this forest are teak, mahogany, ramin (*Gonystylus bancanus* Kurz), rubber wood, meranti (*Shorea* sp) and other kinds of timber species (1). The area covers the production forest of 64.3 millions hectares. Forest based product such as plywood, furniture & component, building materials, rattan, paper and pulp play a very important role in Indonesian economic development (2). Almost all of those products need technology of surface coating for improvement of their physical and chemical properties as well as their performance for decoration.

UV curing is widely used in Indonesia mostly in wood based industries such as for curing of coating of parquet, table top, fancy plywood , fancy veneer and other furniture components . Other application are in printing industries such as to cure over print varnish for magazine, printing ink for labelling , cigarette papers, packaging materials, printed circuit board (PCB) and dental materials. Due to the high capital investment and limited volume of radiation curable products, radiation curing of surface coating using low energy of electron beam (EB) is used only on limited number of products such as on parquet, ceramics and marbles (3,4). At present two low energy Electron Beam Machines have been installed i.e. one at the Centre for Research and Development of Isotopes and Radiation Technology, BATAN with the energy of 300 keV , 50mA (since 1984) and one at a private company (500 keV, 20 mA) which is used for cross linking of rubber thread for tire (since 1996).

The outbreak of the monetary crisis started in mid- 1997, has its impact to the domestic market and export performance of plywood & veneers, wooden furniture & component, flooring industries as well as writing and printing coated paper . This paper

describes the market and impact of the monetary crisis to the market of radiation curing , especially to the wood processing industry.

2. DEVELOPMENT AND CONSTRAIN OF IMPLEMENTATION OF UV CURING IN INDONESIA

Wood panel

In 1996, there are 120 wood panel industries producing raw wood panels such as plywood, particle board, MDF, LVL, OSB, block board have been established in Indonesia. Around 30 manufacturers produced secondary process plywood, particle board and block board which are widely used in the furniture and housing industries. Around 20 % of the wood panel produced were coated mostly using catalyst method. Four of the leading secondary process plywood industries used UV curing process to produce around 150 000 m3 of fancy plywood and parquet flooring yearly, 80% of those products were exported (3). In 1998, 19 manufacturers exported secondary process plywood such as fancy plywood and parquet flooring.

As an impact of the monetary crisis, Indonesian wood surface coating industries either using conventional or radiation curing technology are facing with financial problems. Radiation curing of surface coating is a highly capital industries because of the main component for production (about 60 %) are imported.

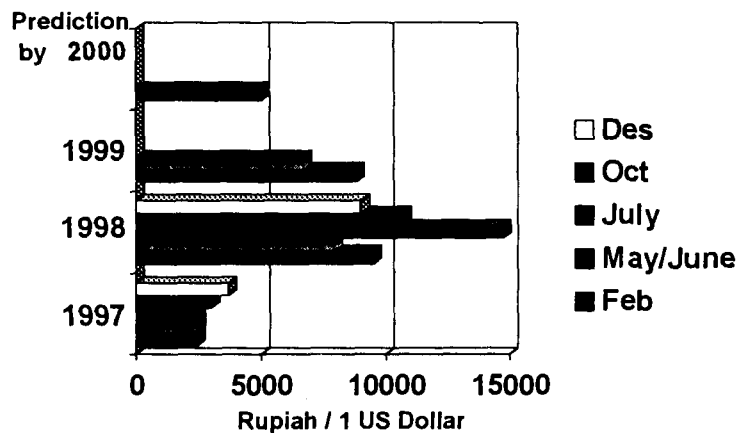


Fig. 1. Fluctuation of the conversion rate Rupiah vs US Dollar 1997 - 2000

Those components are substrate materials (wood, metal, paper), radiation curable materials, photo initiator, wood- working machinery, radiation sources i.e EB and UV , tool and spare-parts. Among those components , only 40 % are available locally i.e. substrate materials and unsaturated polyester resins. The high price of radiation curable materials, machinery and radiation sources are the main constrain to expand their activity. The increasing prices of the curing products affect significantly the local market (5,6).

The Indonesian currency (Rupiah) fell from Rp 2400 to Rp 7000 per one US dollar since mid of 1997. In 1998 the rupiah fluctuated and once time reached the lowest value i.e. Rp 15000 per US dollar. In the first six months of 1999, the rupiah gradually

strengthen to around Rp 7000 per one US dollar. By the year of 2000, the Government predicted the value to Rp 5000 per US dollar (Fig 1) (7).

The Percentage Growth of GDP (Growth of Domestic Product), inflation rate and export value were also affected by the current crisis (Fig.2). In 1998, the GDP negative growth reach up to minus 13 % from 6.7% in 1997 and the total export value decreased up to - 20% from 0.4 % in 1997. On the contrary the inflation rate increased up to 72 % in 1998 from 13 % in 1997 . The Government predicted that the inflation rate can be reduced to 20 % or less by the end of 1999. The growth of industrial sector of wooden products and other forest products decreased from minus 2.09 % in 1997 to minus 18.45 % in 1998, pulp and printing products decreased from 8.98 % in 1997 to minus 11.3% in 1998. The political situation give a significant influence to the improvement of the current monetary crisis (8).

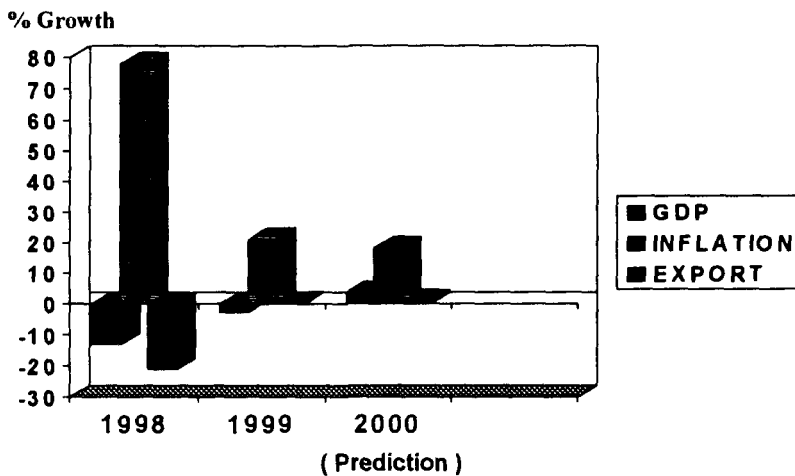


Fig 2 . The Effects of the Monetary Crisis on Percentage Growth of GDP (Growth of Domestic Product) Inflation rate and Export value

Up to now, one major problem faced by wood panel and wooden furniture industries is the supply of good quality wood materials. The scarcity of the wood materials caused by the Government policy to cut the export tariff of logs and saw timber to 30 % by June 1998 and 15 % by December 1999 from 200 % in 1997 will accelerate the log export. Due to the shortage of log supply the wood processing industries are operating at only 30 to 40 % of their capacity. The log supply also decreased caused by the forest fire in Kalimantan and Sumatra islands in 1997 (9). To overcome all of those problems, the industrial sectors should be able to turn the currency crisis to their gain by increasing the export value. Although a number of the companies may be able to go for more export, many of them face difficulty to increase their capital due to the high interest rate. The interest rate increased from 20% in 1997 to around 50% in 1998 and since June 1999 the rate decrease to 23 % per year.

Furniture and components

Over the last two or three years, Indonesia's wooden furniture output has been growing at significant rates. In 1996, it reached 1,649,000 cubic meters, up 54% from previous year. Despite the monetary crisis, Indonesia's wooden furniture output rose further by 1.3% in 1997, however such output declined sharply to minus 11% due to slumping global demand, which has been caused by the global monetary crisis. The value of Indonesia's processed wood exports has not been optimal, not only because of the volume has relative small but also the added value has been very low. This is indicated by the fact that although the volume of Indonesia's furniture exports rose 18.8% in 1997, the value dropped by 6.2% . However, according to data from the Investment Co-ordinating Board, as many as 34 new investment projects in the wooden furniture industry were approved in 1998, of which 28 were approved under the foreign investment scheme (10,11).

UV curing technology is used mostly for topcoat of table and other furniture components such as kitchen set, door and window.

Foreign exchange earning of forestry products such as plywood & veneer, furniture & component and paper & pulp, which is related to UV curing technology can be seen at Table I.

Table I. Foreign Exchange Earnings of Some Forestry Products from 1994 to 1998 in million US \$ (11,12)

Products	1994	1995	1996	1997	1998	% Trend 1994-1998
Plywood & Veneer	3720.25	3465.97	3598.99	3413.32	2079.95	-11.11
Furniture & component	956.87	943.99	1070.61	972.27	484.06	-12.48
Paper & Pulp	735.97	1452.04	1387.35	1427.78	2115.44	23.30
Printing materials	79.12	118.58	122.96	93.05	65.28	- 6.08

Foreign exchange earning of the Furniture and the Components decreased about 50%, from US\$ 972. 27 (million) in 1997 to US\$ 484.06 (million) in 1998, with the percentage trend of minus 12.48% from 1994 to 1998. The earning of the products of plywood and veneer as well as printing materials was also reduced by the trend of -minus 11.11% and minus 6.08% respectively . The earning from pulp and paper industries increased by the trend of 23% from 1994 to 1998.

Caused by the increasing price of the secondary wood processing, the local market reduced up to 40 % in 1998. While many industries look to stagnant or even negative growth, The Indonesian Wood Panel Association (APKINDO) has recorded 5 - 10 % growth for the wood processing industry in 1998 .

Other application

Some significant development in using UV curing are still exist such as on radiation curing for printing ink, adhesive, labelling, PCB, cigarette paper and dental materials. Radiation curing for printing ink and labelling as well as for cigarette paper are most application in this group (13).

3. FUTURE MARKET

During the monetary crisis, almost all of the industry in Indonesia suffered of financial difficulties including the industry that used radiation curing system. After the monetary crisis, its predicted that the market of UV/EB curing will increase in Indonesia due to the following reasons (14):

- Development less toxic radiation.
- Improvement of photoinitiator properties that providing faster, deeper cure, and reduced yellowing for UV-curing systems.
- Development of more feasible and economical of electron beam curing systems.
- Although the equipment and radiation curable materials tend to be more expensive than conventional one, but advantages in productivity provide cost effective solutions especially for mass production.
- Awareness of an efficient and friendly environmental process, such as radiation curing of surface coating technology.
- The employment of both ISO 14000 and ISO 9000 as the certification of production method and management systems.
- The hope that monetary crisis will be over as soon as possible.

4. CONCLUSIONS

- Development of radiation curing using ultra-violet has increased not only in the wood coating industry such as secondary process plywood, flooring and furniture industry, but also in printing inks, dental materials, adhesives, and electronic applications. Some industries look stagnant or even negative growth, due to the monetary crisis.
- The wood processing industries including the radiation surface coating still grows at a range of 5 - 10 % for the last two years. The production capacity increase but the foreign export earning decreases to minus 11 %.
- The use of more efficient and environmental friendly process, diversification of raw materials, ecolabelling & certification, employment of ISO 14000 and ISO 9000 are important factors to considered to increase the market of radiation curing while hoping that the crisis will be over.

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