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SOLIDIFICATION AND STABILIZATION OF ELECTRONIC INDUSTRY WASTE

BY

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ABSTRACT

This dissertation deals with the problem of epoxy mix which is a scheduled waste from the electronic industry. It comprises mainly titanium oxide, TiO_2. This research was carried out to investigate the quantity of waste generated at Fairchild Semiconductor and to examine the reduction potential and / or treatability of the electronic solid waste. Solidification and stabilization and leaching procedures were used to test the solid matrix. Two types of binders, Ordinary Portland Cement (OPC) and white cement were used. Activated carbon was also used as an additive. Three tests were carried out using the solidified samples and they were Toxicity Characteristics Leaching Procedure (TCLP), American Nuclear Society Leach Test (ANS 16.1) and compressive strength. The heavy metals detected from the leachate were Ti, Ba, Zn, Pb, Cu and Fe. The TCLP results revealed that the binders were able to immobilize all the heavy metals up to 12%-65% . The high pH value of the untreated waste, OPC and white cement, 12.53, 11.53 and 12.10, respectively, show that they are basic in nature. At 90% waste loading, the percentage of leachable fraction for Ti was 62.7%, Ba was 25.9%, Zn was 26.8%, Pb was 23.0%, Cu was 18.9% and Fe was 12.0%. Generally, the addition of activated carbon (AC) with cement reduced the leaching of all the metals concern as compared with merely cement binding. For example the percentage of leachable fraction for Ti in 90% waste loading was reduced from 62.7% in waste without AC to 31.8% in waste with AC. The ANS 16.1 leaching procedure revealed the same trend as for the TCLP results. The leaching rate of Ti in 90% waste loading was 0.0416 cm/day for first interval, Ba was 0.016 cm/day, Zn was 0.008 cm/day and Pb was 0.005 cm/day. The leaching rates for Cu and Fe was similar with Pb at 0.04cm/day. It was observed that the leaching rate of the

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heavy metals in cement with AC treated samples was generally lower than the cement treated samples. The leaching rate of Ti in 90% waste loading for the first interval decreased from 0.0416 cm/day to 0.0271 cm/day. On the other hand, the leaching of Ba in 50% waste loading also decreased from 0.016 cm/day to 0.012 cm/day. The hardening time of the untreated waste was 25-40 hours, whereas for cement-based binder it reduced to 15-30 hours. The compressive strength of solidified specimens increased as the cement loading decreased and also as the days progressed. The compressive strength readings ranged between 68-73 Mpa for 50% cement loading, 69-75 Mpa for 40% cement loading, 71-76 Mpa for 30% and 20% loading and 73-78 Mpa for 10% cement loading, after 1, 7, 14, and 28 days respectively, which is higher than the standards guidance (ASTM C 39 or D 1074) value of 414kPa. Cement-based solidification was able to reduce the leachability of all the heavy metals investigated. OPC and white cement both could be used as binder because both are equally good. But to save cost, OPC will be a better choice. The present disposal cost per annum is about RM60,000 and the cost of cementitious based S/S is RM72,900 for OPC.

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ABBREVIATIONS

%	Percentage
cm	Centimeter
m	Meter
mm	Millimeter
MPa	Mega Pascal
kg	kilogram
mg	Milligram
ug	Microgram
L	Liter
ml	Milliliter
°C	Degree celcius
s	Second
lbf	Pound Force
in	inch
RM	Ringgit Malaysia