STUDIES OF COPOLYMERIZATION OF DEGRADED NATURAL RUBBER AND METHYL METHACRYLATE

BY

CHANTIMA PRATEEPASANE (B. Sc. in Chemistry)

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE
(PHYSICAL CHEMISTRY)

IN THE
FACULTY OF GRADUATE STUDIES
OF
MAHIDOL UNIVERSITY

1986

ABSTRACT

Copolymer of degraded natural rubber and methyl methacrylate was prepared in toluene solution at 80°C for 10 hours, using benzoyl peroxide as the initiator. Effect of a) the ratio of MMA to degraded natural rubber used b) molecular weight of degraded natural rubber in the range 1.2×10^4 to 4.5×10^5 and c) non-rubber constituents in degraded natural rubber on the product were studied.

Degraded natural rubber of molecular weights 7.6×10^4 to 4.5×10^5 caused temporary gelation during copolymerization. Some reactions using degraded natural rubber of molecular weights 2.1×10^4 and 1.2×10^4 ended with phase separation. Studies were made on non-phase separated products obtained from 10 hours copolymerization reactions. The crude product obtained was a mixture of non-reacting degraded rubber (5-34%), copolymer (50-70%) and poly (methyl methacrylate) homopolymer. It was observed that percent PMMA homopolymer increased while percent unreacted LR decreased with increasing amount of the starting MMA. The percentage of copolymer shows no particular relation to the initial proportions of the reactants. Furthermore, for the proportion of LR to MMA is 1:2 percent PMMA and percent unreacted LR tend to decrease while that of copolymer increases with increasing molecular weight of purified LR. Non-rubber constituents have no effect on the percentages of free PMMA, unreacted LR and copolymer. The mole ratios of MMA units to isoprene units in the copolymer fraction, deduced from NMR measuremant, were found to vary directly with the ratio of MMA to degraded rubber used as starting material. These mole ratios were not affected by the molecular weight and impurities of LR used as the reactant.

For crude products obtained from each molecular weight of LR used, tensile strength increases while the elongation at break decreases with increasing ratio of MMA units to isoprene units in the crude products. Hardness of the products prepared from unpurified LR of all molecular weights showed the increasing trend while the hardness of product obtained from purified LR of all molecular weights did not show any remarkable trend. In these cases the effect of purification of LR on tensile strength and elongation at break is not clear. The plotting of tensile strength, elongation at break and hardness of crude products obtained from unpurified and purified LR of all molecular weights and all proportions of LR to MMA against the mole ratio of MMA units to isoprene units in crude products indicate that tensile strength and hardness tended to increase while elongation at break tended to decrease with increasing proportion of MMA units to isoprene units.