ABSTRACT

The present investigation describes the latex-stage epoxidation with in-situ formed performic acid and characterization of epoxidized natural rubber, effect of different process variables like reaction time, reaction temperature, concentrations of latex and other reagents, type of secondary acid, mode of addition of reagents, agitator speed and the neutralization methods on the yield and quality of the epoxidized product. It has been found that with increase in latex concentration both yield as well as secondary reaction products increased. Increase in dry rubber content (drc) of latex increases the microcoagulation. The increase in reaction temperature accelerates the epoxidation rate as well as the rates of secondary reactions. The use of a secondary acid in the in-situ generated peracid system has been found to improve the product quality. Speed of agitation of 300 rpm has given minimum secondary reaction and microcoagulation. The mode of addition of reagents, viz., simultaneous and drop wise, has been found to affect the product distribution. Minimum tetrahydrofuran formation has been detected when acid is added drop wise but the yield is comparatively low. It has been found that small traces of acid present in ENR initiates the side reactions during aging. Use of some phenyl hydrazine derivatives improves the aging behaviour. Aging behaviour also has been found to improve considerably by partial and selective hydrogenation of ENR. It has been found that the processability of gum ENR is poor like NR. Reactive blending of small quantity ethylene-acrylic acid copolymer (EAA) with ENR, which results in a EAA grafted ENR (EAA-g-ENR) improves the extrusion processability of gum ENR considerably. The kinetics of epoxidation reaction has been studied and kinetic model based on the actual rate of formation of epoxy groups has been developed taking into account of the aspect of secondary reactions. The model shows good correlation with experimental data. This model has been further modified for the prediction of maximum possible extent of epoxy content for a given concentration of acid.

KEY WORDS : Natural rubber Latex, Epoxidation, Characterization, In-situ formed Performic acid, Agitation, Secondary acid, Mode of reagent addition, Aging, Stability, Processability, Optimum process condition, Kinetic model, Stabilized ENR, NMR, IR, DSC, GPC, Hydrogenation, Reactive blending, Mechanochemical degradation.