Abstract

Pyrolysis of Sunflower Oil Mucilages for Fluxing Bitumen [†]

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The reduction of greenhouse gas emissions requires increasing the use of energy from renewable sources and reducing dependence on fossil fuels and energy imports, thus contributing to the security of energy supply. Pyrolysis has proven to be a promising technique for converting biomass into fuel.

The mucilages used in the experimental program came from the refining of sunflower oil. Mucilages were characterized by thermal analysis, determination of density, viscosity, and saponification index. Stable dispersions of mucilages were obtained with a nonionic polyoxyethylene 20 sorbitan monooleate surfactant (Tween80). The molybdenum catalyst was prepared using ammonium heptamolibdate as precursor. The pyrolysis of mucilages was performed in a laboratory continuous stainless steel tubular reactor heated in an oven with temperature control system and automatic feeding pump. The pyrolysis experimental test was carried out at atmospheric pressure and 500 °C temperature in the isothermal reaction zone. The composition of the liquid fraction resulting from the pyrolysis was determined by gas chromatography (GC–MS/MS triple quadAgilent 7890 A). A road bitumen D 50/70 penetration grade was selected for the preparation of fluidized bitumen with pyrolysis products. The homogenization of the mixture of road flux and bitumen was carried out in a 250 mL autoclave provided with an anchor-type stirrer and a thermostatic heating jacket.

Results: The stability test of the prepared emulsions was carried out for crude mucilage and mucilage emulsions with different concentrations of emulsifier. The recorded stability curves showed that the stability of the mucilage emulsions improved with the increase of the emulsifier concentration up to 3% wt. The chromatogram of liquid phase compositions separated during the catalytic pyrolysis process in the presence of Mo catalyst showed a high content of unsaturated fatty acids and a low content of saturated fatty acids and linear aliphatic hydrocarbons

The stabilization of the mucilage from the refining of vegetable oil was achieved by re-emulsifying it in the presence of a nonionic surfactant. The main processes in pyrolysis of mucilages are decarboxylation which results in linear hydrocarbons and solvolysis of the lecithins and glycerides present in the by-product fatty acids. The pyrolysis liquid fractions contain compounds with optimum polarity for solubilizing the bitumen and for stabilizing its colloidal

structure. The low volatility of these compounds does not adversely affect the aging characteristics of fluxed bitumen such as loss of mass and residual penetration.

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