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Synthesis and application of a new bio-polyol based on white mustard seed oil (*Sinapis alba*) for the production of flexible polyurethane foams

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ABSTRACT

In the face of increasing environmental awareness and the increasing need to find ecological alternatives to petrochemical raw materials used in production of polyurethanes, more and more attention is being paid to natural seed oils. They can serve as a source of eco-friendly polyols for production of e.g. polyurethane foams. This study focuses on the synthesis of new bio-polyol raw material derived from "cold-pressed" mustard oil, and evaluation of the basic physicochemical properties of flexible polyurethane foams produced with increasing content of bio-polyol. The synthesis of bio-polyol was carried out in two steps. In the first step, the double bonds of unsaturated fatty acids were epoxidized in situ using peracetic acid. In the next step, obtained epoxidized mustard oil was subjected to an oxirane ring-opening reaction using 2,2'-thiodiethanol. Basic properties of bio-polyol, such as hydroxyl number, acid number, density, and viscosity, were determined. The chemical structure was confirmed using Fourier Transform Infrared Spectroscopy (FTIR). In the next stage of the study, the synthesized bio-polyol was used to produce flexible polyurethane foams. Eleven foams were obtained: one reference foam and 10 foams modified with bio-polyol from mustard oil. The bio-polyol content in the formulation ranged from 0 php to 50 php. The amount of bio-polyol increased every 5 php. The obtained foams were tested for apparent density, rebound elasticity, CLD40 hardness, SAG factor and tensile strength. The results showed that the use of bio-polyol based on mustard oil had a significant impact on the foam properties. Foam containing 40 php of this raw material was found to have optimal performance properties. The use of renewable raw materials, such as vegetable oils, is an example of actions consistent with the principles of green chemistry and sustainable development doctrine, that efforts aimed at reducing the negative impact of industry on the natural environment.

CONCLUSIONS

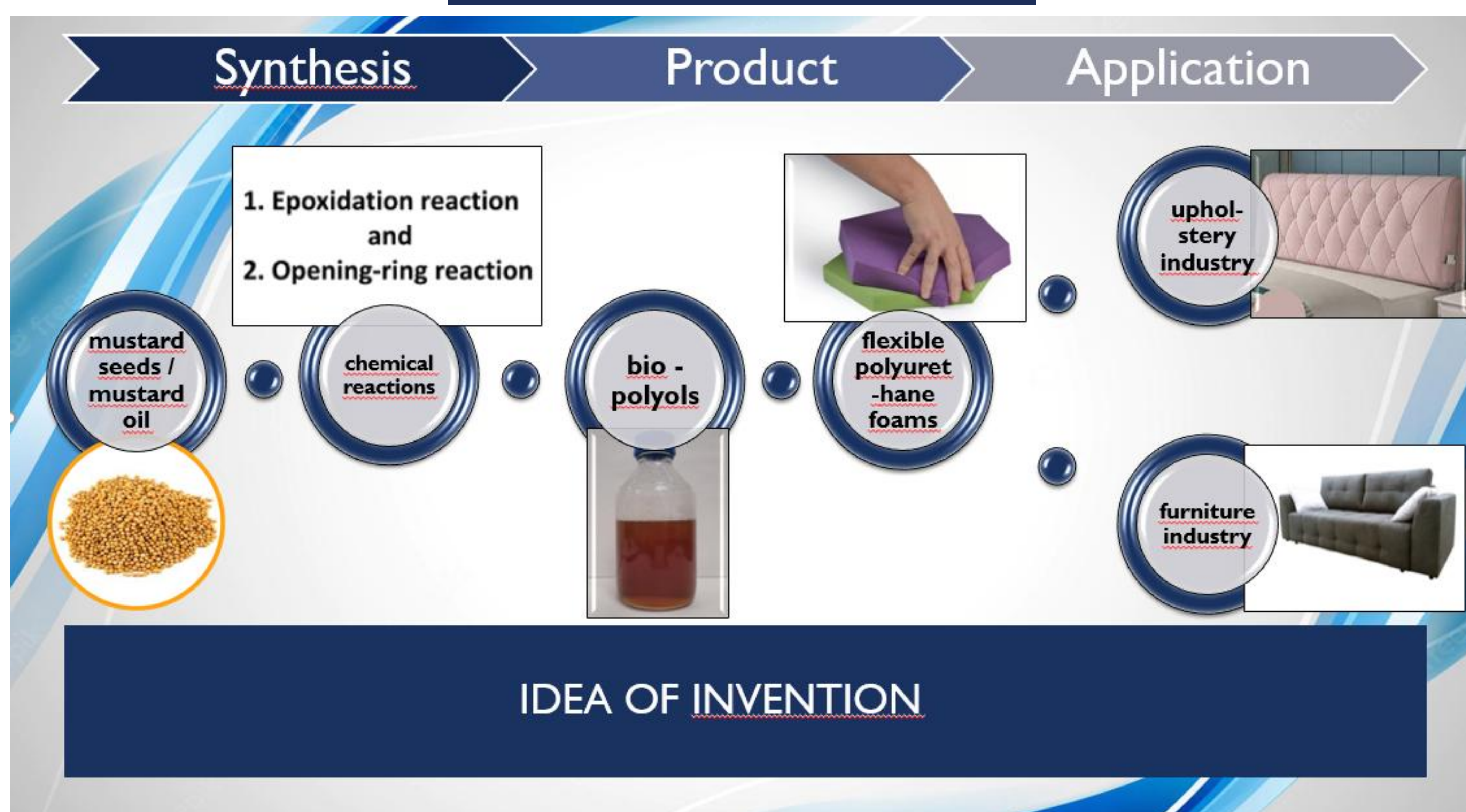
- the „ECO” aspect limiting the consumption of petrochemical raw materials from the processing of crude oil in favor of easily renewable raw materials,
- the "BIO" aspect the processing of mustard seeds results in the production of a bio raw materials (bio-polyols), which perfectly fits the doctrines of sustainable development and Green Chemistry,
- universality of this technology - possibility of obtaining various polyurethane materials based on synthesized bio-polyols,
- economical aspect – bio polyols based on mustard oil is cheaper than petrochemical polyols

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OBJECTIVES



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