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Application of humins from sugar dehydration processes

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PURPOSE OF THE ABSTRACT

The production of chemicals via acid-catalyzed dehydration of sugars is inevitably related with the formation of humins [1,2]. In current biorefinery process designs, humins are burnt to generate heat that can be integrated back into the process. However, the development of high-end applications for humins can contribute to further improving the process economics of a biorefinery. In order to support humins application research, an extensive analysis of the material was performed and has revealed its complex furan-rich molecular structure [3]. It is noteworthy that humins described in literature are often different from humins obtained in the industrial processes. For example, literature humins are often solid, while industrial humins can also be viscous liquids (Figure 1) [4]. This presentation will shed light on the recent progress in application research on industrial humins.

Humins to fuels and chemicals

An efficient way to obtain more value from humins is to gasify the complete stream to syngas, which is used for the production of synthetic natural gas. Alternatively, diesel, olefin waxes or methanol could be produced from the obtained syngas. After gasification at low temperature, aromatics and ethylene were separated as co-products. Separation of these products can increase the economic viability of humin gasification [5]. An alternative way of humins valorization is to change their properties by chemical modification. Humins with a decreased viscosity can be applied as bunker fuel [6], while other modifications are targeting application in asphalt [7].

Humins to materials

It was found that humins can form solid foams (Figure 1) [8,9] when heated. Above 160 °C, condensation and crosslinking reactions lead to the formation of these foams, which were modified to produce growth substrates for agricultural applications [8]. Further modification of the humins based foam can increase the pore volume for the production of active carbons that are applied in purification or catalyst supports [9,10]. Another high-end application of humins was found in composites. Flax mats were impregnated with humins (Figure 2). After curing with a catalyst, a hydrophobic composite material with enhanced strength was obtained [11]. These humin composites have potential applications in automotive and building industry or consumer products.

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FIGURES

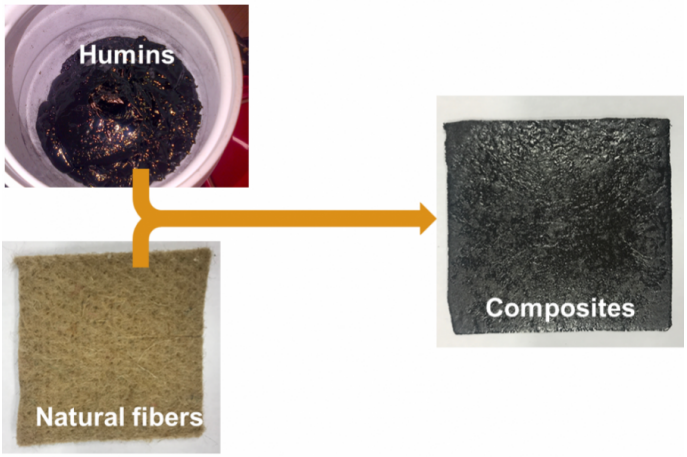

FIGURE 1
Figure 1
Raw humin (left), humin based foam (Right).

FIGURE 2
Figure 2
Humins and natural fibers can be used to produce composites.

KEYWORDS
Sugar dehydration | Humins | Materials | Fuels

BIBLIOGRAPHY