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Characteristics of lignin precipitated with organic acids as a source for valorisation carbon products

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Abstract:

The biorefinery concept prescribes that the biomass should be utilized in its entirety to produce high value chemicals and materials, as well as energy. Lignin is the second most abundant biopolymer and a by-product of multiple lignocellulosic biomass derived industries. It's richness in carbon appropriates it for far more than the industry is currently utilizing it for, therefore production of high value products (and energy) from lignin could be a significant step towards appreciating the biorefinery concept. Hardwood (HW) and softwood (SW) lignin obtained from a South African kraft mill black liquor was precipitated with sulphuric and organic acids. Recovery of lignin after precipitation was achieved by an improved stepwise centrifugal washing methodology, which improved the recovery time as compared with straightforward filtration after precipitation. The sulphur content varied between species, with SW organic acid precipitated samples showing the lowest sulphur content. Thermogravimetric analysis (TGA) of the HW and SW lignin samples in air revealed differences in the main thermal decomposition region of the TG curve. The strength of the acids appeared to play an important role in the thermal degradation of the lignin samples, that is the lignin precipitated with the weaker organic acid showed greater mass losses compared with sulphuric acid precipitated ones. TGA under nitrogen showed carbon yields acceptable for all the lignin samples. SEM micrographs showed swelling in the lignin chars, however all char samples revealed differences in morphology of their structures showing that different precipitation acid media, would produce different carbon structures, thus different valorization products.