In future research, developing materials, fuels and energy devices from renewable resources would be fascinating yet demanding practice, which will have a direct impact on industrial applications, and economically viable alternatives. This talk presents a novel and emerging concept of generating new chemicals, intermediates and products in a ‘Biorefinery’. Our continuous efforts in this area led us to develop new glycolipids from industrial byproducts such as cashew-nut-shell-liquid, which upon self-assembly produced nanoarchitectures including lipid nanotubes, twisted/helical nanofibers, low-molecular-weight gels and liquid crystals. More recently, we have developed multiple systems based on biobased organic synthesis by chemical/biocatalytic methods for functional applications. We used the ‘chiral pool’ of carbohydrates using the selectivity of enzyme catalysis yield amphiphilic products from biobased feedstock including amygdalin, trehalose and vitamin-C. Amygdalin amphiphiles showed unique gelation behaviour in a broad range of solvents such as non-polar hexanes to polar aqueous solutions. Importantly, an enzyme-triggered drug-delivery model for hydrophobic drugs was demonstrated by using these supramolecularly assembled hydrogels. Intriguingly, by combining biocatalysis, with principles of green and supramolecular chemistry, we developed building blocks-to-assembled materials. These results will lead to efficient molecular design of supramolecular architectures and soft materials from underutilized plant/crop-based renewable feedstock.

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