Unlocking the full potentials of the biomass-new technologies for cascading use of both biomass (terrestic and marine) and industrial side streams

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ABSTRACT (Max 500 ord):

Sustainable and efficient State-of-the-Art biorefinery technologies focus on unlocking the full potentials of the biomass feedstock, getting the most out of both the complexity of the biomass structures and its energy content. The trend is to develop new biorefinery technologies for a broader spectrum of biomasses, including terrestrial and marine; agricultural and industrial; municipality waste and sludge. This creates a need for many new types of enzymes. By using our PPR sequence analysis technology platform, allowing for prediction of function directly from sequence, we have been able to make fast track discoveries from complex sequence data and bring it in concrete use within new biomass conversion technologies. Among these accomplishments, discoveries of new enzymes relevant for decomposition of the recalcitrant proteinaceous keratin polymer will be presented. More specifically the latest results about possible new functions of the Lytic Polysaccharide Mono-Oxygenases (LPMOs) will be highlighted, made possible by PPR analysis; and exemplified by testing a new hypothesis for keratin degradation mechanisms in nature. Furthermore new types of hot spots for enzyme discoveries will be presented (e.g. marine environments; anaerobic digestion consortia; insect gut channels; and the secretomes of the group of early lineage zoosporic fungi). An overview of the potentials for new biobased products from biorefineries will be given: product potentials from the yellow biomass (straw, stover and wood chips) include several value chains based on upgrade of the cellulose, the hemicellulose and the lignin components, respectively; the latest development is the use of lignin for production of binders and new functional materials as well as for making higher value products (e.g. vanillin). From the green biomass can be producedprotein-rich food and feed ingredients, C5 oligo sugar-based animal feed products with gut health promoting effect; and the cellulose fibers can be used to make a sugar platform to support growth of bacteria or fungi for production of chemicals, materials (as e.g. bioplastic) or fuels. From the red biomass (slaughterhouse by products and side streams) health promoting protein-rich products can be produced, e.g. designed for people with special nutritional requirements; and high iron containing products for combating iron deficiency etc. The blue biorefinery has three major types of feed stocks. fish cut-offs and by-catch; side products and waste from mussels, shrimps and crabs; and the maybe most well developed right now, upgrade of macroalgae biomass to food and feed ingredients; to skincare and wound healing; as well as to antioxidants and pharmaceuticals. Furthermore the grey and the brown, wet and mixed biomass such as municipality waste and sludge, bacteria can be used to support bacterial growth, bacterial strains which can e.g. produce the building blocks for production of bioplastic or biochemical.

KEYWORDS (3-6):
Enzyme discovery; Higher value biobased products; Unlocking the full potentials of biomass