Greening the pharma industry

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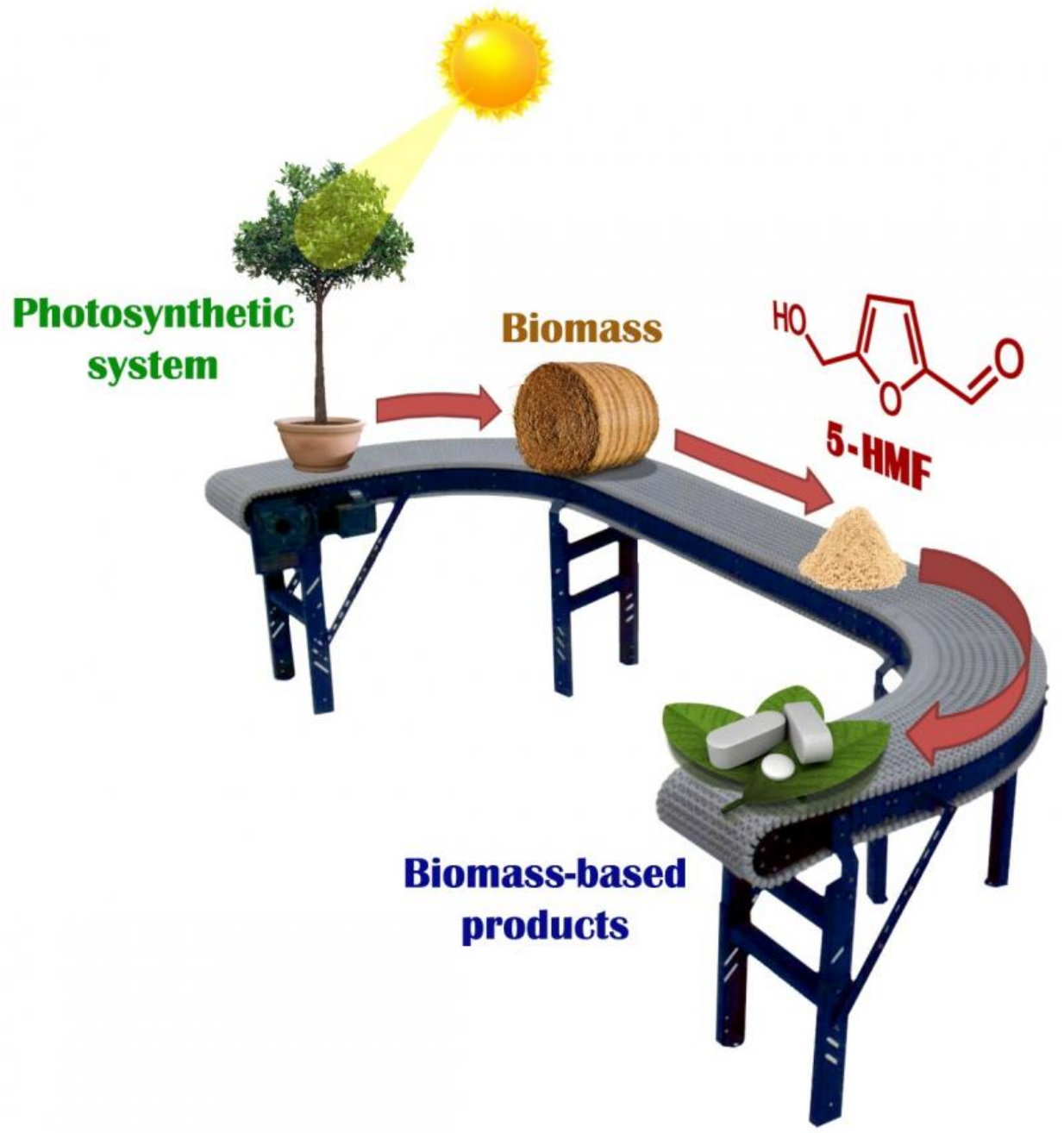

The new process is attractive because it neutralises carbon, which contributes to global climate change. Credit: Zelinsky Institute of Organic Chemistry

Synthesizing life-saving pharmaceuticals from natural biomass can be more cost-efficient than traditional methods and produces fewer toxic byproducts.

By applying 'green chemistry' techniques, Russian researchers say they can use plant biomass to produce industrial quantities of a basic ingredient, or 'platform chemical', for useful pharmaceutical compounds.

The researchers have used the platform chemical to manufacture model products that include, for example, a stomach antacid. There is potential for far more. The chemical, 5-hydroxymethylfurfural (5-HMF), is under research in several fields of chemistry and appears poised to be a building block for a new generation of organic synthesis procedures.

The new process is attractive because it neutralises carbon, which contributes to global climate change. The source material, plant biomass, draws in carbon through natural photosynthesis. The new process then converts this biomass to 5-HMF. Then the starter molecule is further processed to make other chemicals with uses in organic chemistry, materials science, biofuels and pharmaceutical drugs.

Using environmentally sustainable processes to synthesize commercial molecules costs less and creates less waste than traditional chemical manufacturing methods.

Synthesizing a kilogram of a drug using traditional chemical methods

creates anywhere from 30 to 100 kilograms of waste byproducts, many of them toxic. Making 5-HMF using green chemistry creates only water as a byproduct.

Researchers at the Zelinsky Institute of Organic Chemistry say that older, oil-based forms of 5-HMF decompose very quickly, a deal breaker for large-scale industrial use. Many platform chemicals are oils, but oilbased 5-HMF has an unusual problem. With as few as 1 to 3% impurities, it oxidizes and degrades badly in less than a month. The degraded feedstock reduces refining efficiency, increases waste and drastically cuts yields of the desired product.

Repurifying it is not cost effective. The researchers developed a catalysed process to make a crystalline solid form of 5-HMF that is cleaner than the oil-based version—around 99.9% pure—and doesn't degrade. They did this by continually evaporating water from the surface of the biomass during the reaction. This caused the ionized liquid still in the system to form what the researchers call nanostructured water compartments.

These aided efficient catalysis and prevented impurities, resulting in a stable form of the chemical that gives much higher yields in model reactions.

The researchers are now working to develop further efficient green processes to produce pharmaceuticals and drug molecules directly from biomass.

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