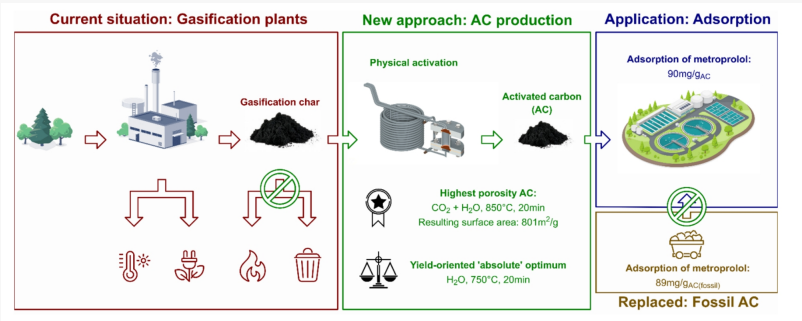
Renewable high-quality activated carbon from low-quality by-product

FAYETTEVILLE, GA, UNITED STATES, March 27, 2025 /EINPresswire.com/ -- Gasification of wood for green energy production is a key strategy in the fight against climate change. The process converts wood into a combustible gas at high temperatures that can be used as a fuel or to generate electricity. In some gasification reactors, dirty wood, including bark and needles or even waste wood can be used as feedstock. However, about 10 % of the wood still remains as a solid by-product: gasification char. While plant operators struggle to find uses for this residue, it has some similarities to activated carbon, particularly the high carbon content, and thus could be upgraded to activated carbon.



Production of renewable activation carbon from a gasification by-product by physical activation

In a study published in the journal Carbon Resources Conversion, a team of Austrian researchers focused on producing activated carbon from gasification char by physical activation. In the process, oxidising gases at high temperatures create tiny pores, in which pollutants can be captured.

“While activated carbon is typically derived from hard materials such as fossil coal or biogenic shells, which are conducive to high porosity, gasification char originates from softer materials (wood), making it difficult to achieve high adsorption capacities and economic feasibility,” explains first author David Gurtner, a PhD student at BOKU University. “Nonetheless, I believe gasification char has the potential to be a useful resource.”

Furthermore, Gurtner noted that there is a dearth of studies on the topic, with previous studies lacking economic analyses, a systematic approach and comprehensiveness.

To that end, the researchers aimed to optimise porosity and micropollutant adsorption while maximising the yield using Design of Experiments, a powerful statistical tool. Despite the existing challenges, they succeeded in producing high-quality activated carbon with a surface area of 800 m2/g.

“To put this figure into perspective, one teaspoon of this activated carbon has the surface area of an ice hockey field,” shares Gurtner. “Furthermore, the adsorption capacity could be increased by a factor of 11, and mild H2O activation (≤750 °C, ≥20 min) was the most effective approach.”

The process has since been successfully upscaled at a commercial gasification plant with promising results.

“The demand for renewable activated carbon is set to continue growing,” says co-author Jan Back, an expert in water treatment. “New EU regulations will require the removal of micropollutants in large wastewater treatment plants by 2045, and Switzerland has already demonstrated the feasibility of the large-scale application of activated carbon in wastewater treatment plants since 2016.”

The researchers hope that their study will encourage the gasification industry to adopt this value-added pathway for renewable activated carbon production, thereby replacing the use of fossil activated carbon in wastewater treatment.

References
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