Upgrading paper mill wastewater materials to forestry fertilizers and plant nursery growth media

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Recirculate nutrients to the forest

A growing tree uses nutrients and alkali ions from the soil. When the tree is harvested, these substances are removed from the forest, leaving a more acidic and less nutrient-rich soil. For sustainable forestry in a future with increased use of wood-based products, these minerals should be recirculated. Researchers from Karlstad University, together with industrial partners have in a 3-year project NärSkog, developed a system to recirculate plant nutrients to forest soil. The project group includes participants from pulp mills, forest owners, nurseries, converting companies, and the Swedish Forestry Agency. All participants contribute to the expertise needed to develop the entire new value chain.

Savings at the nursery

Growth trials with 10,000 pine and spruce seedlings at an industrial nursery showed that 15 – 30% of the peat growth media could be replaced with hydrochar. The nutrients within the hydrochar and its capacity to adsorb ammonia from the fertilizer, halved the needed dose of fossil based fertilizer. The seedlings grown in hydrochar was as strong or stronger than the reference seedlings. A life cycle analysis showed major environmental improvements.

Nutrients accumulates at Pulp and Paper Mills

In Sweden, more than 50% of the harvested wood is destined for pulp mills. Nutrients and alkali ions are there accumulated in ash and in wastewater sludge. At a large Mill approximately 10,000 tons of ash and 50,000 mixed sludge are produced each year. These materials are today treated as waste materials.

Our vision was to recirculate ash and sludge together, to maximize the benefits to the soil, by upgrading to a consumer-approved soil amendment product. Such a product would be useful both in plant nurseries and as soil amendment or fertilizer for forest soil.

A new soil amendment product

It is not possible to spread raw sludge in the forest. The answer was hydrothermal Carbonification (HTC). When using soil amendment products in forestry, transportability is paramount. Hydrochar was easy to pelletize also with high concentrations of ash. Lab-scale leaching trials showed hydrochar pellets to release nutrients appropriately slowly and to increase pH and alkalinity in forest soil. A planned further study of large-scale forest soil enrichment will show how much the hydrochar and ash mix will decrease the need for forest fertilizing.

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