



CircInWater

**Project Partners:** Finnoflag Oy; Suomen

ekosovellus Oy

**Country:** Finland**Industrial ecosystem:** Energy-intensive industries**Date of the award:** 29/09/2023**Duration:** 01/12/2023 – 30/11/2024

### ~ Resource recovery and production by industry like nature biorefinery ~

The BioResque project tested the patented circular economy concept for the forest industry and prepared it for full industrial scale. The project partners were Finnoflag Oy and Suomen Ekosovellus Oy. The project used water-smart Industry Like Nature® biorefining technology for resource recovery and production from side streams. The process utilised the principles of nature's material cycles by using both microbes and their enzymes as biocatalysts.

Fibre sludge, biosludge, and lake bottom sludge samples were received from the Collaborator Paper Mill and tested in the Finnoflag laboratory to define the exact conditions of the Biorefinery process for cleaning wastewater and reducing environmental load. The carbon is bound to soil amendments and returned to circulation through plants, agricultural products, and/or forestry products.

Fourteen development versions of the side-stream-based soil amendments, under the trade name Aurobion®, were produced and thoroughly analysed, featuring various combinations of industrial side streams, directly from the process, or as environmental deposits. Selected prototype soil amendments were tested at the University of Helsinki's Viikki research greenhouse.

A movable semi-industrial Biorefinery pilot was prepared and tested, and a soil amendment sample from the test was analysed. Aurobion® soil amendment prototype product was distributed to the berry bushes of Suomen Ekosovellus for field testing.

In lab-scale and pilot tests, active natural microbial strains were successfully incorporated into the fresh process-derived or sedimented lake bottom-derived side-stream biomasses. Innovatively, safe industrial microbial strains and enzymes were combined with the natural microbial community in the production process. With appropriate steering, the production was thus optimised for sustainability and feasibility goals.

The forest industry's side streams could be converted into a microbiologically upgraded, safe, and non-toxic prototype product for soil amendment purposes. This could mitigate environmental health, climate, and water risks, while also helping to avoid the combustion of the organic material in question and simultaneously lowering the corresponding costs. Biorefinery process development was advanced for the Collaborator paper mill by taking concrete steps, starting with their side streams and valorising them into soil amendment products.