



TECHNICAL REPORT MICROBIAL BIOMASS

Conversion of CAP-effluent to microbial biomass

SHORT SUMMARY FOR PRACTITIONERS

EN version

The RUSTICA project aims to develop an adaptable, eco-friendly bio-based fertiliser from agricultural side streams, in this way upcycling unused bio waste and increasing the recovery of valuable nutrients. This fertiliser will consist of different building blocks, each with their own specific properties, and will be produced by 5 innovative technologies. One of these technology providers is Avecom.

In the context of the RUSTICA project, Avecom assessed the feasibility of the production of Microbial Protein (MP) from pretreated biowaste or CAP solutions (Carboxylic Acid Platform). The CAP-solutions are produced by DRANCO NV by anaerobically digesting the organic residues. In the following MP production process, the carbon and nutrients in the CAP solution are converted into microbial biomass, rich in proteins, by means of a mixed-culture aerobic fermentation process. This MP is subsequently dewatered and dried.

A total of 11 lab-scale fermentation tests to optimise and produce MP were performed from diverse CAP-samples. These samples all contained high COD concentrations and variable short chain carboxylic acid (SCCA) profiles. In general, over 90% of the initial COD concentration of all samples was converted into microbial biomass. This indicates that the SCCA profile has no significant impact on the MP production, which emphasises the robustness of the technique. The produced microbial biomass was consistently of high quality and contained protein percentages up to 70%, which makes MP suitable as a slow releasing nitrogen source. Moreover, a high biomass yield of 0.35 g TSS/g COD was obtained, which corresponds with a protein production of 200 mg protein per g of COD added. These results prove the suitability of CAP waters for the production of MP.

SHORT SUMMARY FOR PRACTITIONERS

NATIVE version

Het RUSTICA-project heeft tot doel een aanpasbare, milieuvriendelijke bio-gebaseerde meststof te ontwikkelen uit agrarische zijstromen en op deze manier ongebruikt bioafval te upcyclen en waardevolle voedingsstoffen terug te winnen. De bio-gebaseerde meststof zal bestaan uit verschillende bouwstenen met elk hun eigen specifieke eigenschappen en deze bouwstenen zullen geproduceerd worden door 5 innovatieve technologieën. Eén van deze technologie leveranciers is Avecom.

In de context van het RUSTICA project onderzocht Avecom de haalbaarheid van de productie van Microbieel Eiwit (MP) uit voorbehandeld bio afval of CAP-oplossingen (Carboxylic Acid Platform). De CAP-oplossingen worden geproduceerd door DRANCO NV door organische reststromen anaëroob te vergisten. In het daaropvolgende MP-proces worden de koolstof en nutriënten in de CAP-oplossing omgezet in microbiële biomassa, rijk aan eiwitten, door middel van een aëroob fermentatieproces met gemengde culturen. De geproduceerde MP wordt vervolgens ontwaterd en gedroogd.

In totaal werden 11 laboratoriumschaal fermentatie testen uitgevoerd om MP te optimaliseren en te produceren op basis van verschillende CAP-stalen. Deze stalen bevatten allemaal hoge COD-concentraties en variabele korte keten carboxylzuur profielen (SCCA). In het algemeen werd meer dan 90% van de oorspronkelijke COD-concentratie van alle monsters omgezet in microbiële biomassa, wat aangeeft dat het SCCA-profiel geen significante invloed heeft op de MP-productie. De geproduceerde microbiële biomassa was van hoge kwaliteit en bevatte eiwitpercentages tot 70%. Bovendien werd een hoge biomassa opbrengst van 0.35 g TSS/g COD verkregen, wat overeenkomt met een eiwitproductie van 200 mg eiwit per g toegevoegd COD. Deze resultaten bewijzen de geschiktheid van CAP-water voor de productie van MP.



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CONTEXT

As one of the technology providers within the RUSTICA project, Avecom is responsible for the production of microbial protein (MP) from CAP waters. The protein-rich dried biomass has the ability to act as a slow-release nitrogen source and will be used as a building block to the final RUSTICA bio-based fertiliser/blend.

PROBLEM

The RUSTICA technology for CAP production from biowaste is rather new and the quality and composition of the produced CAP solutions can vary, depending on the type of fruit and vegetable waste used as feedstock and on the process conditions that were applied during the CAP treatment by the partner DRANCO. The suitability of different types of CAP waters for optimal MP production needs to be tested and the most optimal conditions for the MP process, which also depend on the used CAP solutions, should be determined.

APPROACH

AVECOM developed lab scale tests to determine the feasibility of different organic substrates to be converted into microbial protein. Over 10 different CAP solutions, produced by DRANCO from different agricultural side streams, were analysed and tested for MP production at lab-scale. Furthermore, the operation conditions of the MP fermentation reactors were modified to optimise the process and assess the effect of different operational parameters on the MP process.

OUTCOME

1. Waste-derived CAP waters showed to be a very suitable feedstock for the production of MP
2. The SCCA profile of the CAP waters did not have an important impact on MP production, which emphasises the robustness of this technology.
3. A conversion of the organic compounds (COD) of more than 90% was obtained
4. A high MP yield or biomass growth up to 0.35 g TSS/g COD was achieved
5. A protein content of more than 70% on dry matter of MP was reached

PRACTICAL RECOMMENDATIONS

- For an optimal MP production process with CAP waters as feedstock, the use of calcium hydroxide during the CAP pretreatment should be avoided, since this results in poor microbial protein quality. Instead, sodium or potassium hydroxide can be used. Furthermore, the CAP waters need to be diluted to 20-30 g COD/L and the TSS concentration in these waters must be limited.