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Modeling and Analysis

Conversion Economics of Forest Biomaterials: Risk and Financial Analysis of CNC Manufacturing

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Abstract

Commercialization of cellulose nanocrystals (CNC) presents opportunities for a wide range of new products. Techno-economic assessments can provide insightful information for the efficient design of conversion processes, drive cost-saving efforts, and reduce financial risks. In this study, we conducted techno-economic assessments for CNC production using information from the USDA Forest Products Laboratory Pilot Plant, literature, and discussions with experts. Scenarios considered included variations related to greenfield, co-location, and acid recovery. Operating costs, capital investment, minimum product selling price (MPSP), financial performance metrics, and the effect of drying and higher reaction yields on CNC manufacturing financials were estimated for each scenario. The lowest MPSP was found for the co-location without acid recovery scenario, mainly driven by capital investment. Risk analysis indicates 95% probability of manufacturing costs lower than USD 5900/t of CNC (dry equivalent) and a MPSP lower than USD 7200/t of CNC (dry equivalent). Finally, based on our analysis, we provide guidance on process optimizations that can improve the economic performance of CNC manufacturing process. In addition, a risk profile of the CNC manufacturing business is provided. © 2017 Society of Chemical Industry and John Wiley & Sons, Ltd

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