

Deliverable 6.7.1

Assessment of underutilised feedstocks – Composition and Supply

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PUBLISHABLE SUMMARY

The BIOrescue project aims to develop and demonstrate a new innovative biorefinery concept based on the cascading use of spent mushroom substrate (SMS). The BIOrescue technologies target the extraction of nutrients, enzymes and other bioactive compounds from SMS and the subsequent conversion of the extracted SMS derived cellulose to biopesticides and enzymes and the conversion of lignin and hemicellulose to nanocarriers. SMS contains significant amounts of lignin but relatively low concentrations of cellulose and hemicellulose. The project therefore targets the supplementation of additional underutilised feedstocks that can improve the composition of a mix containing SMS. Wheat straw has been selected as one supplementary feedstock due to its attractive cellulose content and its current use within existing mushroom farm infrastructure.

However, BIOrescue also involves an examination of whether other feedstocks could be suitable for co-feeding with SMS in the configured process scheme of the BIOrescue conversion technologies. In accordance with the strategic priorities of the Bio-Based Industries Consortium (BIC) and the Bio-Based Industries Joint Undertaking (BBI-JU), feedstocks that are currently underutilised and seasonal have been examined for their suitability. The work that was undertaken initially involved a scoping study to select candidate feedstocks from four of the main mushroom producing regions in Europe (South, West, North, and East). These feedstocks were selected based on literature data on their composition, their arisings in the chosen regions, and whether they could be considered as seasonal and underutilised.

Celignis personnel then contacted stakeholders in each of the selected regions in order to obtain samples of the candidate feedstocks for detailed compositional analysis within the Celignis laboratory. This analysis, coupled with further detailed studies on the availability of these potential feedstocks, informed a decision on a chosen feedstock from each region for subsequent socioeconomic/sustainability modelling in deliverable D.6.7.2 due for M36.

The Southern region (comprising Italy, France, and Spain) had the greatest number of candidate feedstocks as a result of the wide array of agricultural products, and their associated underutilised residues, produced. Detailed analysis and investigation was undertaken for prunings from a number of crops (olive trees, vineyards, almond trees, and peach trees). In addition, pomace samples from olives and grapes were also studied. Based on the attractive cellulose content and the large quantities of residues available, as well as the current lack of high-value applications for these residues, vineyard prunings were selected as the chosen feedstock from this region.

The Western region (comprising the UK and Ireland) is of great importance for BIOrescue since life-cycle-analysis and socioeconomic modelling, undertaken in Work Package 6 (Environmental, resource, techno-economic and social impacts assessment), would particularly focus on the mushroom farm of project industrial partner Monaghan Mushrooms, based in Tyholland in Co. Monaghan in Ireland. Additionally, the underutilised feedstocks selected for this region would undergo conversion, within the project, using the technologies developed by other partners. However, the list of suitable candidate feedstocks in this region was much shorter than the one for the Southern region. Three samples were selected for compositional analysis (barley straw, oat straw, and poultry litter) with the outputs of this analysis leading to the selection of oat straw and barley straw as the chosen feedstocks. Particular conditions related to the Irish economy and agricultural sector can lead to consider these straws as seasonal underutilised feedstocks where this may not be the case in other parts of Europe where they can be in high demand.

The Northern region (comprising The Netherlands and Germany) also had a relatively short list of candidate feedstocks once straws had been excluded (due to their selection for the Western region and the fact that straws are typically not underutilised in this region). Two samples were analysed, the first (tobacco stems) did not have sufficient cellulose to be considered suitable, however, the sample of sugar beet pulp was considered to have a reasonable lignocellulosic composition and became the chosen feedstock for this region.

The Eastern region was represented by Poland, whose fruit industry is of particular importance and prominence in Europe. Four pomace samples were analysed by Celnigis personnel with apple pomace ultimately selected as the chosen feedstock due to its lignocellulosic composition and its abundance in Poland.