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Use and biotechnological exploitation of dairy industry's waste

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Abstract:

In Italy, the dairy industry is one of the most economically relevant in the food sector. On average, one kilogram of cheese is produced from 10 kgs of milk, generating 9 kgs of whey. Cheese whey represents one of the most abundant and polluting agro-food wastes. While the proteins contained in cheese whey are concentrated by ultrafiltration and used in the food and feed industries, the sugar component (*i.e.,* the lactose) is still little exploited and its disposal is a serious problem.

Here, we report a way to valorise lactose, in specific to exploit the permeate derived as a secondary by-product from whey ultrafiltration. This by-product was added to the growth medium and served as an inducer for the recombinant production of β-galactosidases in *Escherichia coli* cells. The recombinant enzyme was used to hydrolyse lactose into its constituent monomers (*i.e.,* glucose and galactose). Then, these monosaccharides were chemically modified to obtain new building blocks for the synthesis of bio-polyesters.

Overall, the rational use of cheese whey permeate and the reduction of its disposal represents a major challenge that can be achieved in a circular economy context thanks to the tools offered by a biotechnological and multidisciplinary approach.