Opportunity of wastes recycling for bio-production processes

Yelizaveta Chernysh, Olena Yakhnenko

Department of Applied Ecology, Sumy State University, UKRAINE, Sumy, 2, Rymskogo-Korsakova Str.,
E-mail: y.chernysh@ecolog.sumdu.edu.ua, o.jakhnenko@ecolog.sumdu.edu.ua

The mineral and organic wastes/by-products can be useful as nutritional needs of Lactic acid bacteria under bio-production of polimer composites. The present paper deals with the biochemical analysis of opportunity of lactic acid production and possibility of phosphogypsum and sewage sludge using as supplements under fermentation. The biochemical reactions were formed based on the KEGG database.

Keywords – phosphogypsum, sewage sludge, lactic acid production, supplements, biochemical analysis

Introduction

Today, biobased plastics have an established market that is growing rapidly both in Europe and worldwide. Europe is expected to remain the main consumer for biobased plastics through to 2030. Published market reviews on bioplastics have very different views on the expected future demand with projected annual growth rates of between 15% to 35% between 2010 and 2020 [1]. The chemical synthesis of bioplastic may be limited due to limiting source of naturally available raw materials in future and negative feature for environmental pollution. Whereas renewable sources including lingocellulose, starch, agricultural waste materials, sugars and others are abundant substrates for fermentative production [2].

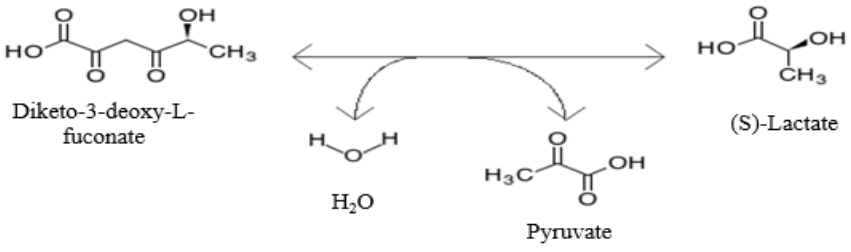
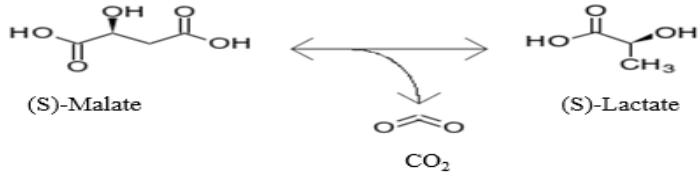
Main part

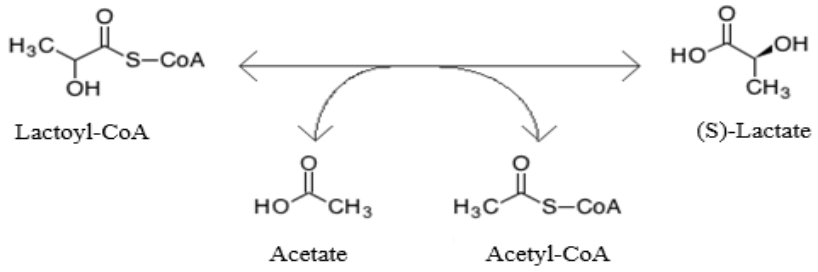
When lactic acid (LA) has been harvested, it can be polymerized into plastic LA using various methods, each of which requires varying concentrations of lactic acid and additives [3]. The present paper deals with the biochemical analysis of opportunity of LA production and possibility of phosphogypsum (PG) and sewage sludge using as supplements under LA fermentation.

The biochemical reactions under Lactate metabolism ((S)-Lactate; L-Lactate; L-Lactic acid) were formed based on the KEGG (Kyoto Encyclopedia of Genes and Genomes) database and present on the Table 1. These results are consistent with the studies described in the works [4-6].

Table 1

Enzyme properties and biochemical reaction under LA fermentation

Enzymes	Bio-chemical reaction
1	2
2,4-diketo-3-deoxy-L-fuconate hydrolase	
malolactic enzyme : (S)-malate carboxy-lyase	

1	2
propionate CoA-transferase	

Lactic acid bacteria (LAB) need sources of the carbon, nitrogen, phosphorus and other nutrients. PG and sewage sludge can be useful for the extending feedstock basis for the LA fermentation. They can be useful as cheap carbon sources for fermentation processes and the additional nutrients are important as well in view of an economic feasible entire process.

While the nutrient recycling strategy is expected to be a tool to tackle particularly diffuse sources, it is also important to look for opportunities in the present point sources and especially in cases where results can be achieved quickly and cost-effectively. While the PG waste sites contain vast amounts of phosphate phosphorus and potentially hazardous waste, it is important to keep on monitoring the sites and take measures to eliminate risks to the environment and human health. On the other hand PG contain useful elements (Ca, S, P, Mg, K, Na, microelements) and municipal sewage sludge contain organic carbon compounds for microorganisms growth. The primary sewage sludge is easily biodegradable since it consists of more easily digestible carbohydrates and fats, compared to activated sludge, which consists of complex carbohydrates, proteins and long chain hydrocarbons.

Conclusion

LA as a bio-product is healthier and more desirable for food, drink, and pharmaceutical industries because it is easier to metabolize by a living organism. The mineral and organic wastes/by-products (after pre-treatment) can be useful as nutritional needs of LAB. Further experimental investigation and computational modelling should be held for estimation on the effectiveness of the use of PG and sewage sludge as a nutrient supplement for bacteria growth.

References

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