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Synthesis of high-value natural benzaldehydes by Basidiomycete-mediated reduction of the corresponding benzoic acids

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PURPOSE OF THE ABSTRACT

Substituted benzaldehydes of phenylpropanoid origin are the natural products of utmost industrial importance [1,2]. These compounds have been widely employed for food flavouring. Their extraction from the natural sources or chemical synthesis can be considered as the fundamental processes in the flavours and fragrances field. Benzaldehyde (1), anisaldehyde (2), vanillin (3) and piperonal (5) (Figure 1) are considered as the most important aromatic compounds in this aldehydes class and their production has steadily increased over the years [3]. The consumer's preference for 'natural or organic' aromas has increased the request for flavours possessing the 'natural' status. The resulting shortage of aromatic aldehydes of extractive origin, such as vanillin (3), veratraldehyde (4) and piperonal (5), can be offset by developing a new biotechnological synthesis method.

Here, we report a study on the microbiological reduction of five natural benzoic acid derivatives, namely p-anisic, vanillic, veratric, piperonylic, and eudesmic acids, to produce the corresponding fragrant aldehydes. We found that different Basidiomycota strains, including white-rot, brown-rot saprophytic, and ectomycorrhizal species can efficiently perform this transformation, with good chemical selectivity and tolerance to the toxicity of substrates and products. Besides confirming the carboxylic acid reductase activity of the already exploited fungi *Pycnoporus cinnabarinus*, we discovered that other species such as *Pleurotus eryngii*, *Pleurotus sapidus*, *Laetiporus sulphureus* as well as the saprophytic fungi *Lepista nuda* are valuable microorganisms for the synthesis of anisaldehyde (2), vanillin (3), veratraldehyde (4), piperonal (5) and 3,4,5-trimethoxybenzaldehyde (6) from the corresponding acids. For these flavours, a preparative biocatalytic process was proposed. Starting from benzoic acids of natural origin, the obtained aldehydes can be commercialized as high-value natural flavours, in compliance with the European and USA regulation of food flavouring substances.

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FIGURES

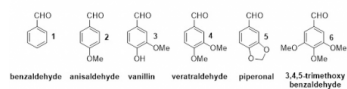


FIGURE 1

Some relevant natural benzaldehydes of interest in F&F field.

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FIGURE 2

KEYWORDS

natural flavours | Basidiomycetes | biotransformations | CAR activity

BIBLIOGRAPHY

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