

Patents and Literature

Biocatalysis in Nonaqueous Media

JONATHAN S. DORDICK

*Department of Chemical and Materials Engineering,
University of Iowa, Iowa City, IA 52242*

Received March 15, 1988; Accepted March 15, 1988

ABSTRACT

Biocatalysis in nonaqueous media is being used in increasing regularity both in academic and industrial research. A variety of biocatalysts have been used in organic media including enzymes, multi-enzyme systems, and whole cells. In addition, the nonaqueous media has encompassed both monophasic and biphasic solvent systems, enzymes and whole cells in reversed micelles, enzymes and cells in nearly anhydrous (no added water) solvents, and enzymes catalytically active in supercritical fluids and the gas phase. Recent US and overseas patents and scientific literature on biocatalysis in nonaqueous media are surveyed. Patent abstracts are summarized individually, and literature references are divided into major subheadings.

INTRODUCTION

The objective of the Patents and Literature Section is to summarize and cite recent developments in industrial and academic research as portrayed within the scope of current patents and literature and to highlight emerging biotechnological research areas. Three subject areas will be surveyed in 1988: biocatalysis in nonaqueous media; enzymatic and microbial production of optically active compounds; and monoclonal antibodies for clinical applications. The subject of the first Patent and Literature Section of 1988 is Biocatalysis in Nonaqueous Media.

PATENTS

This section covers the patents (including US and foreign) concerning biocatalysis in nonaqueous media from the period of January 1985 to December 1987. The major search headings were Enzymes or Cells or Bioconversions, with the crossterms: organic solvents, organic media, supercritical fluids, gas phase, and reverse micelles. Chemical Abstracts data base was used. The major patents recovered under the conditions of the search are described below. Copies of US patents can be obtained for \$1.50 each from the Commissioner of Patents and Trademarks, Washington, DC 20231.

Crook, S., Macrae, A. R., and Moore, H.

EDIBLE FATS

EP 170431, Feb. 5, 1986

Assignee: Unilever, Ltd.

A hardstock fat for use in manufacturing of margarine or other emulsified food spreads is prepared by fat or vegetable oil interesterification by a microbial lipase. In particular, a hardstock fat was manufactured by treating soybean oil plus 0.45 parts of lauric acid dissolved in 2.9 parts hexane with immobilized *Mucor miehei* lipase at 40°C.

Diamond, S. E., and Regina, F. R.

BINDING ASSAY WITH AMPLIFIED READ-OUT GAS-PHASE
DETECTION

EP 173055, Mar. 5, 1986

Assignee: Allied Corp.

An immunoassay procedure is described that uses gas-phase sensing of detectable moieties. The procedure consists of performing a specific binding reaction for the target binding pair in the presence of an enzyme, the concentration or activity of which being a function of the amount of target binding pair member, and in the presence of a substrate that can be converted into a detectable species in a volatile form by gas chromatography.

Drouzd, J. W., and Bailey, M. L.

BIOTRANSFORMATIONS

US 4,560,657, Feb. 1, 1984

Assignee: Shell Internationale Research Maatschappij B.V.

Alkylene oxides are produced from alkenes by an ethylene utilizing microorganism *Mycobacterium* NCIB 11626. The organism was cultured at 30°C and pH 6.6 in a mineral salts medium containing (NH₄)₂SO₄ to which 25 mL ethylene/min were added as C source. After the cells were harvested,

100 mg by dry weight were added to a 2-phase system of 0.5 mL phosphate buffer and 10 mL isooctane containing 5% 1-octene. A total of 0.2 mL ethylene were added to the sealed system which was shaken for 160 h. The result was 1,2-epoxyoctane with a specific production of 127 mol/g cell-h.

Empie, M. W.

RESOLUTION OF RACEMATES OF AMINO ACIDS

EP 171862, Feb. 19, 1986

Assignee: Stauffer Chem. Co.

Racemates of optically active amino acids can be resolved in a 2-phase solvent system in which the racemate is dissolved in a water-immiscible solvent and contacted with water. The equilibrium produced in the aqueous and organic phases enables an enzyme dissolved in the aqueous phase to selectively hydrolyze one isomer. The resulting optically pure amino acid can be recovered from the aqueous phase.

Klibanov, A. M., and Kirchner, G.

ENZYMIC PRODUCTION OF OPTICAL ISOMERS OF
2-HALOPROPIONIC ACIDS

US 4,601,987, Jul. 22, 1986

Assignee: Massachusetts Institute of Technology

A method is described for resolving racemic 2-halopropionic acids by lipase catalyzed asymmetric esterifications in an organic medium. The preferred lipase is from *Candida cylindracea* and is used for selective esterification to yield R isomers of 2-phenoxy propionic acid and its esters. These compounds have herbicide activities. Thus 4.34 g 2-chloropropionic acid, and 2 g lipase plus 11 mL 1-butanol were added to 400 mL hexane at 30°C and vigorously agitated. The resulting Bu(+)-R-2-chloropropionate was produced in 80.8% yield after 6 h. The S isomer can be isolated from the resulting solution optimally after 68% of the R ester is formed.

FATTY ACID ESTER PRODUCTION CATALYZED BY LIPASE

JP 60 78587, May 4, 1985

Assignee: Lion Corporation

Fatty acid esters are produced by the alcoholysis of an oil or fatty acid monoalkylester catalyzed by lipases from *Alcaligenes*, *Arthrobacter*, or *Pseudomonas* immobilized to silica gel. Methyl oleate and methyl palmitate were produced in yields approaching 100%.

Munk, B. H.

PRE-WASH COMPOSITIONS CONTAINING ENZYMES

EP 177183, Apr. 9, 1986

Assignee: Chlorox Co.

Prewash enzyme compounds, effective in removing oil and grease stains are described that contain 60–70% organic solvents mixed with nonionic surfactants and aqueous enzyme solutions dispersed as reverse micelles. Encapsulating the enzymes in reverse micelles protects them from solvent degradation and prolongs their shelf-life.

Pokora, A. R., and Cyrus, W. L.
PHENOLIC DEVELOPER RESINS
US 4,647,952, Mar. 3, 1987
Assignee: The Mead Corporation

The peroxidase-catalyzed synthesis of formaldehyde-free phenolic resins for use as developer aids is described. The reactions are carried out in a number of solvents including both water-miscible and immiscible organic solvents. The phenolic units of the resins are directly bonded to one another through positions ortho or para to the hydroxyl group and are selected from the group consisting of an alkyl group, a halogen atom, an aryl group, a phenylalkyl group, an allyl group, a carboxyl group, and an amino group. The resulting resins are reacted with a metal salt to give the final products, which are useful as developer resins in forming colored images by reaction with substantially colorless electron donating compounds.

LITERATURE

This section surveys the literature in the area of biocatalysis in non-aqueous media published from January 1985 to December 1987. The headings and crossterms are the same as listed in the patent search, above. Once again, Chemical Abstracts data base was used. In addition to the literature recovered under the search constraints, citations referenced in several recent reviews on the subject are listed. The literature section is divided into the following headings: reviews; books; and research articles. The latter is further subdivided into nearly anhydrous solvent systems, reverse micelles, aqueous-organic biphasic systems, water-miscible organic-aqueous cosolvent systems, supercritical fluids, gas phase, and enzymatic stability in nonaqueous media.

Reviews

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Books

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Research Articles

Nearly Anhydrous Systems

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Water-Miscible Organic-Aqueous Cosolvent Systems

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