Advanced Powder Technology 23 (2012) 532–537

Contents lists available at SciVerse ScienceDirect

Advanced Powder Technology

journal homepage: www.elsevier.com/locate/apt

Review paper

Control of microbial adhesion using fine particle technology

Toshiyuki Nomura *

Department of Chemical Engineering, Osaka Prefecture University, 1-1 Gakuen-cho, Sakai, Naka-ku, Osaka 599-8531, Japan

ARTICLE INFO

Article history:
Received 10 April 2012
Received in revised form 17 May 2012
Accepted 18 May 2012
Available online 28 June 2012

Keywords:
Biocolloid
Microbe
Adhesion
Aggregation
Biotechnology

ABSTRACT

Microbial adhesion to an interface plays an important role in many industrial bioengineering processes. Surface physicochemical properties can be treated as an indicator of the adhesive properties of microbial cells. In this paper, the application of the aggregation/dispersion technique used in fine particle technology to biotechnology is reviewed. By way of illustration, measurements of the surface characteristics of microbes living in an anaerobic digester, analysis of microbial adhesion and aggregation/coaggregation, and their application are introduced.

Contents

1. Introduction

Microbial adhesion to an interface plays an important role in many industrial bioengineering processes. Microbial adhesion is exploited in some applications, such as fermentation, wastewater treatment, and bioleaching, to name a few [1–3]. On the other hand, adhesion causes problems in other fields, such as food contamination, medical implants and device fouling, ship fouling, metallic corrosion, and dental hygiene issues [4–8]. Microbial adhesion occurs on every surface exposed to an aqueous environment but the detailed mechanism has not yet been clarified. Therefore, elucidation of the mechanisms of microbial adhesion will be useful for exploitation or removal of adherent microbial cells and for prevention of microbial attachment. Fine particle technology may prove useful as a model for the elucidation of microbial adhesion phenomena if microbial cells are considered to be living particles.

Anaerobic treatment has received renewed attention for recovering energy from organic waste containing a high percentage of water from the viewpoint of establishing a sustainable society, developing new energy sources, and preventing global warming. In this paper, measurements of the surface characteristics of microbes living in an anaerobic digester, analysis of microbial adhesion and aggregation/coaggregation, and their application are reviewed from the perspective of fine particle technology [9–15].

2. Methane fermentation process

The methane fermentation process is an artificial ecosystem in which many types of microbes exist at high density. Anaerobic digestion of complex organic materials to produce methane

* Tel.: +81 072 254 9300; fax: +81 072 254 9911.
E-mail address: nomura@chemeng.osakafu-u.ac.jp

0921-8831/$ - see front matter © 2012 The Society of Powder Technology Japan. Published by Elsevier B.V. and The Society of Powder Technology Japan. All rights reserved.
http://dx.doi.org/10.1016/j.apt.2012.05.003