IDENTIFICATION OF FLOW PROPERTIES IN BIOSUSPENSIONS

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SUMMARY

The experimental technique with piezoelectric mechanico-electrical transducer and stirring intensity meter (SIM) makes possible to measure the distribution of the local kinetic energy of turbulence in aseptic conditions of heterogeneous nontransparent fermentation broth. This information plays an important role in bioprocess development and in the bioreactor performance.

INTRODUCTION

The aim of our study was to find a suitable method for in situ identification of media flow properties under sterile conditions, which could be afterwards used for comparison of bioreactors performance and for scaling up procedure. All methods known till today have a limited applicability: transport phenomena which govern controlled environment in aerobic bioprocesses influence profoundly the growth and morphology of producing microorganism. In practice it is really difficult to identify chemical and physical influences and to neglect biological factors.

The authors (Vanags et al. 1990) describe the system of piezoelectric transducer coupled with charge amplifier, commutator, microprocessor block, analog output and digital input/output for computer. Fořť et al. measured mean kinetic energy of turbulence in pilot plant fermentors in water-air system and found good correlation with standard laser-Doppler anemometry method. This value does not depend on the contribution of the kinetic energy of gas phase but on the kinetic energy
of turbulence of liquid phase only.

MATERIAL AND METHODS

For testing in real biological systems, two different types of bioprocesses were chosen:

a. shear sensitive mycelial culture *Aspergillus niger* cultivated on sugar beet molasses

b. bacteria *Xanthomonas fuscans* cultivated on sucrose media with substantial change of apparent viscosity in spite of xanthan type biopolymers formation.

Schematic diagram of the system is described in Fig. 1.

Fig. 1. Block diagram of measuring system

Medium flow fluctuations and homogeneity was detected with sterilisable piezoelectric sensor in the form of a small sphere with d= 3-6 mm located on a needle with d= 0,5 - 0,8 mm connected to piezoelement. During fermentation process the sensor was never covered with biomass layer or emulsion of antifoam. The arbitrary position of the sensor was selected according to technological demands of the process in the well mixed regions or zones with small turbulence of fluid flow.