RHEOLOGICAL PROPERTIES OF EXTRACELLULAR POLYSACCHARIDE, PEStan, PRODUCED BY PESTALOTIOPSIS SP.

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SUMMARY

The fluid behaviour of Pestan produced from Pestalotiosis sp. KCTC 8637P was as a non-Newtonian fluid. The rheological behaviour of Pestan solution was examined by Power-law model, Herschel-Bulkley model and Arrhenius equation. As the result, Pestan solution was pseudoplastic behaviour with yield stress. According to increase of Pestan concentration, its flow index was decreased. Thus, low concentrations of Pestan solution were well exposed pseudoplastic property. Apparent viscosity of 0.2 % Pestan solution was 268.2 cP at 14.3 sec⁻¹ and was higher about 2.8 times than that of Xanthan gum solution. Apparent viscosity of Pestan solution was stable over a wide pH and was maximum at pH 8. Also, consistency index of Pestan solution was very stable over wide temperature than that of Xanthan gum solution.

INTRODUCTION

Microorganisms produce a large number of structurally diverse extracellular polysaccharides (EPS) sources with unique rheological properties (Dasinger et al., 1994). The commercial use of EPS is based on their rheological properties which can be influenced by both its sugar composition and the spatial structure of its basic units (Ha et al., 1991).

Microbial polysaccharides have found a wide range of applications in food, pharmaceutical, petroleum, and other industries. Dextran, especially produced by Leuconostoc mesenteroides, is used as a blood expander and Xanthan gum produced by Xanthomonas campestris is used a viscosifier and stabilizer, and pullulan by Aureobasidium pullulans as a plastic material (Ashtaputre et al., 1995). As a rheological and functional properties of microbial polysaccharide produced by various microorganisms is unique and various properties, thus there is still hope of developing new polysaccharide.

In this paper we report the rheological characteristics of a new microbial polysaccharide obtained from Pestalotiosis sp. KCTC 8637P. The sugar component of Pestan was reported at a previous paper (Kwon et al., 1996).
MATERIALS AND METHODS

Crude Pestan preparation
The crude Pestan which was obtained from procedure of previous paper (Kwon et al., 1996) was used throughout in this study. Xanthan gum used as comparison with crude Pestan was purchased from Sigma.

Viscosity measurement of Pestan and Xanthan gum solution
Apparent viscosity of cell-free culture fluid and crude Pestan solution was measured with Brookfield Digital Rheometer model DV-III, USA) equipped with a much-sample adaptor (SC4-34). At each concentration (0.1, 0.2 and 0.5 %, w/v) of Pestan and Xanthan gum solution, spindle SC4-34 which is a high-viscosity adaptor was done at different shear rates (0.28 - 56.0 sec⁻¹).

Rheological properties of Pestan and Xanthan gum solution
The rheological properties of Pestan and Xanthan gum solution were interpreted by using Power-law equation (a) and Herschel-Bulkley equation (b) (Romano and Sabrina, 1995).

That is,

\[ \tau = K \cdot \gamma^n \quad (a) \]
\[ \tau = \gamma_y + K \cdot \gamma^n \quad (b) \]

* SYMBOL EXPLANATION

\( \tau \); Flow index
\( \gamma \); Shear rate (sec⁻¹)
\( \tau_y \); Yield stress (Dyne/cm²)
\( K \); Consistency index (cP)
\( n \); Apparent viscosity (cP)
\( A \); Frequency factor (cP · sec⁻¹)
\( \gamma_y \); Activation energy of flow (Kcal/mol · °K)
\( R \); Gas constant (1.986 cal/mol · °K)
\( T \); Absolute temperature (°K)

RESULTS AND DISCUSSION

Concentration dependence on fluid behaviour
The combined relationships of apparent viscosity and shear stress to shear rate on the various concentrations of Pestan and Xanthan gum solution were investigated by using spindle SC4-34 at 25°C.

![Fig. 1. Logarithm shear stress on the logarithm shear rate of 0.1-0.5% solution of Pestan and Xanthan gum at 25°C.](image-url)