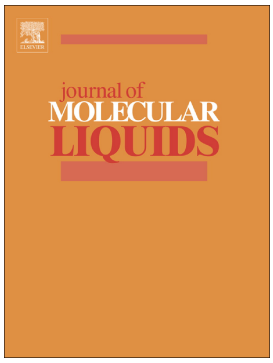


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# Rheological properties of dextrin-riboflavin solutions under thermal and UV radiation effects

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**Abstract**

The combination of saccharides and UV sensitive chemical molecules in the solution form has been in the interest of medicine for treating medical complications and imaging techniques due to their remarkable properties under UV radiation. Therefore, two samples of dextrin based riboflavin solutions containing 10 wt% of dextrin content and 0.1 wt% of UV sensitive riboflavin content were prepared at the room temperature. In order to understand how UV radiation affects the viscosity of prepared solutions at various temperatures, one of the prepared samples was protected from light while another sample was radiated to UV at a biologically harmless wavelength where the absorbance peaks are obtained by UV/Visible spectroscopy. Dynamic viscosity measurements of UV-radiated and un-radiated solutions for different temperatures were performed with constant velocity where the most reliable torque is shown. It was understood that application of UV radiation increased the viscosity value of radiated sample at the room temperature, however; it did not alter the fluid types of test samples. Fluid type of all test solutions was found to be non-Newtonian dilatant fluids as the shear stress vs. shear rate curves of solutions reliably obeyed Ostwald-de-Waele equation. Flow type of all solutions was classified as shear thickening fluids (STF) since power law consistency coefficient ($n$) of Ostwald-de-Waele equation was found to be greater than 1 ($n > 1$). Based on this experimental outcome, the effect of UV radiation on shear thickening behavior of the solutions which include low viscous biocompatible solutions was studied for the first time. Thermal behavior of all test solutions was mathematically modeled via Arrhenius viscosity equation. The degree of STF increased and viscosity of dextrin based riboflavin solutions was found to be slightly greater than other test samples at increasing temperature values after UV radiation. As expected, viscosity values of all test samples decreased at elevated temperatures.

**Keywords:** Biocompatible materials, polysaccharides, UV sensitivity, Arrhenius model, shear thickening behavior, dilatant fluids

## 1. Introduction

Over the past decades, thanks to the development of technology, the extensive use of biological macromolecules in the form of fluids for the purpose of diverse medical implementations from drug delivery systems to tissue engineering has become a common interest in various multidisciplinary research fields [1-2]. Recently, the importance of the essential macromolecules such as carbohydrates and vitamins has drastically increased since these biocompatible molecules are biodegradable and can be derived from natural resources in various ways [3]. The human body uses carbohydrates, also called saccharides in biochemistry, as its main energy source which comes from the breakdown of glucose with glycolysis and oxidative phosphorylation. These processes provide most of the energy need of the body for daily anabolic and catabolic activities [4]. The production of energy initially depends on the degradation of saccharides by hydrolysis with the utilization of different enzymes [5]. Different types of saccharides can form larger molecules to be stored up for further metabolic activities such as starch which includes most of the food sources [6]. Starch, as a polysaccharide,