Abstract

Tumor is a group of abnormal cells formed as a result of the process of excessive and uncoordinated cell division, causing lumps in organs in the body and has the nature of growing rapidly. Tumors are divided into two, namely benign tumors and malignant tumors caused by several factors, including through viruses, chemicals and heredity. Tumor growth can be studied and modeled mathematically using differential equations. In this study, the tumor was represented as a region in $\mathbb{R}^2$ with *free boundary* from the Hele-shaw model known in fluid dynamics. The development of malignant tumor cells is simulated by a mathematical approach using a macroscopic model to determine the characteristics of tumor cells and the *stage* on tumor growth. In this paper it is also discussed that *traveling wave solution* does not describe tumor development as an elastic material, but only *incompressible fluid*. So that the Hele-shaw model is used in this study.

Keywords: *Malignant tumor, macroscopic, stage, free boundary.*