# Characterization of Bio-adhesive derived from Sarawak Native Sago Starch

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**Abstract.** Sago starch has multiple applications in industries such as textile, cosmetics and pharmaceutical, paper and wood. This study focuses on the utilization of sago starch to promote formaldehyde-free adhesives. Formaldehyde-based adhesive commonly used in wood industry emits formaldehyde, which is classified as carcinogen, into the air that has raised concerns over the potential hazards to human health. Sago starch-based adhesive was produced by blending the sago starch with sodium hydroxide (NaOH) and glycerine. Fourier-Transform Infrared Spectroscopy (FT-IR) was used to characterize the chemical changes in the sago starch-based adhesive. The quality of sago starch adhesive was tested according to their viscosity. The mechanical property is analyze based on lap shear (bond) strength of the sago starch adhesives according to ASTM D907 and D143 by using Model D350 Testomeric. Parameters affecting the viscosity of the sago starch-adhesive such as time, temperature, concentration of sodium hydroxide, and the amount of glycerine were studied. The viscosity of the sago starch-based adhesive decreased as the mixing time, temperature, concentration of NaOH and the amount of glycerine increased.

## 1. Introduction

Sago starch comes from sago palm trees such as Metroxylon Sagu as well as other species, M. longispinum, M. sylvestre, M. microcanthum and M. rumphii that can be found in South East Asia [2]. Sago palm is found abundantly in Sarawak covering an estimated area of 60,000 hectares. Sago starch export from Sarawak was estimated about 30,000 to 50, 000 tons with values around US$3.4 million to US$10.8 million [3]. Highly refined starch is used for food industry, while modified starch has a wider application in non-food industry such as textile, pharmaceutical, paper and plywood industry [15]. Even though there is some argument regarding non-food application of starch, sago starch can be considered worthy, since the sago palm has low maintenance cost, high survival rate and high productivity [8]. Plywood industry in Malaysia commonly uses formaldehyde-based adhesive as binder, and a wide application of this adhesive has raised concerns over the potential hazards to human health [14]. Emission of formaldehyde into the air is potentially ingested by human, which may affect their health even with concentration as low as 0.02 ppm. Formaldehyde is classified as a carcinogen, a contributing factor to nasal and lung cancer, and to some extent that links to brain cancer and leukemia. The risk of human exposure to formaldehyde varies depending on its duration and its concentration; long term exposure to low level of formaldehyde may cause respiration difficulty, and short-term exposure to high level formaldehyde may cause fatality [5]. Formaldehyde is a synthetic