

UNIVERSITI TEKNOLOGI MARA

**THE EFFECTS OF PHOSPHOTUNGSTIC
ACID AND FERROUS SULFATE
MORDANTS TOWARDS THE
ENHANCEMENT OF FLOWER EXTRACTS
AS ALTERNATIVE TO HEMATOXYLIN
STAIN**

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DECLARATION OF STUDENT

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification. I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for undergraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Aqueous extract derived from *Hibiscus sabdariffa* (Roselle) and *Costus woodsonii* (Red button ginger) flower were chosen to be used in Papanicolaou stain protocol to counter the problem of limited sources of Hematoxylin. The aim of this study is to identify the most suitable mordant between Phosphotungstic acid (PTA) and Ferrous sulfate (FS) that have the finest result in enhancing the staining ability of both *H. sabdariffa* and *C. woodsonii* on the nucleus of the buccal cells. The dyes were extracted from the flower petals by boiling until it reached 100°C. Qualitative analysis was done by selecting 10 volunteers to evaluate the staining intensities of the nucleus of the cells. From this observation under the microscope, all dyes with and without mordants were able to stain the nucleus. However, cells that have been stained using extracts that were mordanted with Phosphotungstic acid were slightly degenerated and have poor visibility. The quantitative analysis using One-way ANOVA and paired-samples t-test were done on the pH and absorbance of the pure aqueous extracts. Colour intensities were measured in pixels using MIPAR software. The staining quality of the mordanted and non-mordanted natural dyes were compared with the Papanicolaou stain as a gold standard. Qualitative measurement by the independent evaluators was analysed using Weighted-kappa test. Hence, the statistical analysis revealed that dyes mordanted with ferrous sulfate were proven to have better ability in enhancing the staining intensity of extracts from both flowers compared to Phosphotungstic acid. Nevertheless, the dyes from both flowers and Papanicolaou stain were incomparable. But then again, the ability of mordanted dyes and non-mordanted dyes of *H. sabdariffa* and *C. woodsonii* to stain the cells were equivalent. In conclusion, ferrous sulfate is the most suitable mordant in enhancing the staining ability of both flower extracts.

Keywords: Phosphotungstic acid mordant, ferrous sulphate mordant, *Hibiscus sabdariffa* (Roselle), *Costus woodsonii* (Red button ginger), Papanicolaou stain