

# Natural Indicator for Acid-Base Titration from Thai Yellow Flower Extracts

Naruwan Pattarapongdilok, Primpak Malichim, Natthaphol Simmee, and Jirapast Sichaem

**Abstract**—This study was aimed at investigating the efficiency of extract indicators from three yellow flowers in Thailand (*Acacia auriculiformis* A. Cunn., *Crotalaria juncea* L. and *Sesbania javanica* Miq.). The flowers were extracted with deionized water and evaporated in order to get dried extracts. The flower extracts (5% w/w) were prepared as indicator. In the primary experiment, the flower extracts were tested in order to determine their indicator property using three types of solutions, different pH, buffer solutions, HCl/NaOH solutions and CH<sub>3</sub>COOH/NaOH solutions. The results show that the colors will be changed in basic solution. Then, the indicator activities of flower extracts were used in acid-base titration in which a strong base was used as a titrant and the results were compared using a standard indicator, phenolphthalein. The results suggest that the flower extracts can be used as an alternative indicator for strong acid (HCl) – strong base (NaOH) titration and weak acid (CH<sub>3</sub>COOH) – strong base (NaOH) titrations. The color of solution will be changed from light brown to dark brown for *A. auriculiformis* A. Cunn., and transformed from light brown into yellow for *C. juncea* L. and *S. javanica* Miq. when the solutions have more basicity. The color changes were clear and sharp when the strength of NaOH solution was increased. Therefore, the use of these flowers' extracts as indicators is their new application which can be applied in the chemistry class because these natural indicators are safe, cheap and easy to prepare.

**Index Terms**—*Acacia auriculiformis* A. Cunn., *crotalaria juncea* L., *sesbania javanica* Miq., acid-base titration, natural indicator.

## I. INTRODUCTION

Titration or titrimetry is a general laboratory method of quantitative chemical analysis which can be observed from the quantity of a liquid of standard solution, the titrant or the solution of known concentration, to convert the constituent into another form [1]-[3]. A change of color or the formation is used to determine the concentration of an analyte, titrand or unknown solution [2]. The method of quantitative analysis of acid and base by an acid or base of standard solution exactly

neutralizing with an acid or base of unknown concentration is called an acid-base titration [3], [4]. The equivalent point is very difficult to observe because the reaction between an acid and base will yield colorless salt and water. Acid-base indicators, also known as pH indicators, are usually weak acids or bases, which when dissolved in water dissociate slightly and form ions. A good indicator is a weak acid or weak base that is slightly soluble in water. The commercial indicators are relatively expensive and have a toxic effect on the user and can also cause environmental pollution [5].

Therefore, a lot of research is focusing on an alternative to substitute the commercial indicators. The alternative needs to have the end point and equivalence point volumes coinciding closely for low titration error. Moreover, it should be cheaper, more available, easier to be extracted, less toxic to the user and environmentally friendly. A natural indicator is a natural substance typically from a plant origin that can be used to determine the pH of another substance [6].

*Nerium indicum* and *Aspilia africana* extracts can be used as acid-base indicators that can replace phenolphthalein (indicator) because it is easy to find and prepare and yields precise and accurate results [7]. In addition, *Rosa setigera*, *Allamanda cathartica* and *Hibiscus rosa-sinensis* had been effectively used as a substitute for commercial indicators [8].

*A. auriculiformis* A. Cunn. (Fabaceae) is an important medicinal plant and is a well-known source of phenolics, tannins and terpenoids. This plant has been used as natural medicine for the treatment of anti-helminthes, antifungal and anti-microbial effects [9].

*C. juncea* L., commonly known as brown hemp, Indian hemp, Madras hemp, or sunn hemp, belong to Fabaceae family. This plant possesses hypolipidemic, reproductive, antioxidant, antibacterial, antifungal, antidiarrheal, anti-inflammatory, hepatoprotective and many other pharmacological effects. Its leaves showed the presence of carbohydrates, steroids, triterpenes, phenolics, flavonoids, alkaloids, aminoacids, saponins, glycosides, tannins and volatile oils [10].

*S. javanica* Miq. (Fabaceae) commonly known as "Sano" in Thai or "Phak hong hang" (northern Thai). Its flowers are harvested only in the rainy season and commonly consumed in Thailand. In ancient Thai traditional medicine, it was used as an anti-inflammatory for insect bites, detoxification, intestinal abscess healing, stomach discomfort and to relieve internal fever and thirst. The major flavonoids in *S. javanica* Miq. flower extracts are the flavonol glycoside and Quercetin 3-2G-rhamnosylrutinoside [11].

*A. auriculiformis* A. Cunn., *C. juncea* L. and *S. javanica* Miq. have the same natural product chemical that can

Manuscript received November 30, 2018; revised January 28, 2019.

This work was supported by the grant from Bansomdejchaopraya Rajabhat University, Thailand.

Naruwan Pattarapongdilok is with Chemistry Program, Department of Science, Faculty of Science and Technology, Bansomdejchaopraya Rajabhat University, Bangkok 10600, Thailand (e-mail: olin,oo@gmail.com).

Primpak Malichim and Natthaphol Simmee were with Science Program, Faculty of Education, Bansomdejchaopraya Rajabhat University, Bangkok 10600, Thailand (e-mail: primpak31@gmail.com, natthaphon603@gmail.com).

Jirapast Sichaem is with Department of Chemistry, Faculty of Science and Technology, Thammasat University Lampang Center, Lampang 52190, Thailand (e-mail: jirapast.s@gmail.com).