



- [1] A. Braithwaite and F. J. Smith, **Chromatographic Methods**, 5ed. Blackie Academic & Professional, 1996.
- [2] **Chemical Analysis Consumables and Accessories Catalog 1998/1999** , Hewlett Packard.
- [3] **Dionex Product Selection Guide 1997-1998**.
- [4] Douglas A. Skoog, **Principle of Instrumental Analysis**, 3ed. Saunders Golden Sunburst Series, 1985.
- [5] Douglas A. Skoog and James J. Leary, **Principle of Instrumental Analysis**, 4ed. Saunders College Publishing, 1992.
- [6] Goverdina C.H. Derksen, Harm A.G. Niederlander, Teris A. van Beek, **Analysis of Antraquinone in *Rubia tinctorum L.* by Liquid Chromatography coupled with Diode – Array UV and Mass Spectromeric Detection**, *J of Chromatography A*, 119-127 : 978 : 2002.
- [7] **How to Develop, Validate, and Troubleshoot GC Method** , ACS Short Courses American Chemical Society, 2001.
- [8] Joachim Weiss. **Ion Chromatography**, 2ed., VCH, Weinheim. New York, 1995.
- [9] NSITC “ hands – on ” **Training in Science, High Performance Liquid Chromatography**, National Scientific Instrumentation Training Center : Swinburne University of Technology, 1996.
- [10] NSITC “ hands – on ” **Training in Science, Ion Chromatography**, National Scientific Instrumentation Training Center : Swinburne University of Technology, 1996.
- [11] Robards, K., Paul R. haddad, Peter E. Jackson. **Principles and Practice of Modern Chromatographic Method**. Academid press limited, London, 1994.

- [12] Steven B. Schram , PhD. **The LDC Basic Book on Liquid chromatography**, Milton Roy company, 1980.
- [12] **www. agilent.com**
- [13] **www. dionex.com**
- [14] **www. mwa.or.th /~ppqcdept/waterq/waterstd.html**
- [15] คู่มือประจำเครื่อง HPLC รุ่น HP 1100 Isocratic Pump และเครื่องบันทึก – ประมวลผล Integrator HP 3396 Series III ของบริษัท Hewlett - Packard
- [16] คู่มือประจำเครื่อง IC รุ่น DX 500 ของบริษัท Dionex
- [17] คู่มือประจำเครื่อง GC รุ่น HP 6890 ของบริษัท Hewlett – Packard
- [18] ผศ. ดร. สุกัญญา วงศ์พรชัย, อ. ดร. สุนันทา ว่างานต์, และคณะ, **เอกสารการฝึกอบรมเครื่องมือ LC – MS**, ภาควิชาเคมี คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่, 2546.
- [19] แม้น อมรสิทธิ์ และ อมร เพชรสม, **Principles and Technique of Instrumental Analysis**, โรงพิมพ์ ชวนพิมพ์, 2534.
- [20] วัชรวิ ชาตภิตติคุณวงศ์, **เคมีวิเคราะห์ 2 โครมาโทกราฟีของเหลวสมรรถนะสูง CH 334**, ครั้งที่ 1, สำนักพิมพ์รามคำแหง, 2542.



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