# Chromatographic Separation of Some Antiemetics on Silica Gel-Surfactant Impregnated Thin-Layer Plates

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**Abstract**

***A thin layer chromatographic (TLC) separation of five antiemetic agents on silica gel-surfactant impregnated plates using a mixture of ethanol-water-acetic acid (40:50:10) as developing system was studied. The visualization of the spots was done by exposure of the plates to iodine vapour. Of the two surfactants employed (polysorbate-80 and sodium lauryl sulfate) at various concentrations, sodium lauryl sulfate at 1.25% w/v concentration level exhibited the best separation ability.***

**Keyword:** Chromatography, antiemetics, Silica gel-surfactant, Thin-layer plates

## Introduction

Nausea and vomiting are common complications of anaesthesia, surgery, pregnancy and therapies and adversely affect quality of life (Watcha and White 1995). The incidence of nausea and vomiting involves the stimulation of the physiologic vomiting center in the medulla that directly mediates nausea and vomiting (Hornby, 2001). The center can be stimulated by afferent visceral fibers (through dopamine and serotonin), vestibular fibers (through histamine and acetylcholine) and input from the chemoreceptor trigger zone in the base of the fourth ventricle (through dopamine and serotonin). Chemical substances that antagonize any of three primary pathophysiologic pathways can be clinically used as an antiemetic agent. The antiemetics can generally be grouped under antihistamines, anticholinergics, dopamine antagonists, serotonin antagonists and other agents like corticosteroids (Flake *et al.,* 2004). The objective of this present study is to separate five antiemetics on a surfactant-impregnated silica gel using thin layer chromatographic method. It is envisaged that such separation would enable any of the antiemetics to be quantitatively determined in biological fluids particularly when the drugs are administered concomitantly or as a single dosage form containing two or more of the drugs. Combination of antiemetics has been shown to be more effective than the sole use of the drugs because the combination can act synergistically and moreso as different mechanisms are involved in emesis (Prego *et al.,* 1996). Numerous studies have reported the chromatographic separation of chemical substances on silical gel impregnated thin layer plates in order to improve the separation of various classes of substances. Srivastava and Reena (1982) reported the chromatographic separation of some pesticides on silica gel metal salt or phenol impregnated thin layer plate. Other reports (Yasuda, 1973; Lepri *et al*., 1978; Srivastava *et al.,* 1979) have shown that aliphatic amines, amino acids, aromatic amines, diols and phenols can be separated by thin layer chromatography using different metal salts, surfactants and other chemical substances. A survey of the literature shows that impregnation technique has not been exploited to separate antiemetic agents and in this work, we have investigated the separation of five antiemetics using this technique.

## Materials and Methods

**Materials:** Chlorpromazine HCl (May & Baker, England), metoclopramide HCl (Pharmaceutical Associates Inc., USA), promethazine HCl (Baxter Health Corporation, USA), diethylperazine maleate (May & Baker, England), trifluoropiperazine HCl (Mylan Pharmaceuticals Inc., USA), silica gel G (BDH, England) and all other reagents and solvents were of analytical grade.

**Chromatographic analysis:** The TLC plates (thickness 0.25 mm) were coated with slurry of a mixture of 50 g silica gel G and varying amounts of surfactant solutions in 100 ml of distilled water by means a stahl-type applicator. The plates were activated at 60 $\pm$ 2 º C for 24 h. The stock solution (10 mg/ml) of each antiemetic was prepared in water, dilutions made prior to being applied on the layer by means of a micro pipette. After development, the plates were air-dried, placed in the iodine chamber for 5-10 min and the yellow spots on a white background were analyzed for retardation factor values. The surfactants used were polysorbate-80 and sodium laruyl sulfate while the solvent system ethanol: water: acetic acid (50:40:10) found to be most suitable from earlier trials was used.

## Results and Discussion

The $R_f$ values for the plates impregnated with polysorbate-80 and sodium lauryl sulfate are given in Tables 1 and 2 respectively. The results show that the $R_f$ value for all antiemetics decreased with increasing surfactant concentration except metoclopramide that showed an increased $R_f$ value. It was also observed that a 1.25 % (w/v) solution of sodium lauryl sulfate gave the best separation. Trifluoroperazine HCl could not be visualized on the impregnated plates at 2.0 %, 2.5 % (w/v) of polysorbate-80 and 1.0 %, 1.25 % (w/v) of sodium lauryl sulfate respectively.

**Table 1: $R_f$ values of antiemetics on polysorbate-80 impregnated silica gel plate**

| Antiemetics | Detection limit (µg) | Retardation factor ($R_f$ value) Percent polysorbate-80 | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 |
| **Chlorpromazine HCl** | 2.5 | 0.79 | 0.78 | 0.76 | 0.75 | 0.72 | 0.70 |
| **Metoclopramide HCl** | 2.0 | 0.61 | 0.63 | 0.64 | 0.64 | 0.67 | 0.68 |
| **Promethazine HCl** | 1.0 | 0.70 | 0.77 | 0.76 | 0.75 | 0.74 | 0.74 |
| **Diethylperazine maleate** | 10.0 | 0.57 | 0.56 | 0.54 | 0.54 | 0.54 | 0.53 |
| **Trifluoroperazine HCl** | 2.0 | 0.62 | 0.61 | 0.61 | 0.59 | - | - |

**Table 2: $R_f$ values of antiemetics on sodium lauryl sulfate impregnated silica gel plate**

| Antiemetics | Detection limit (µg) | Retardation factor ($R_f$ value) Percent sodium lauryl sulfate | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0.0 | 0.25 | 0.5 | 0.75 | 1.00 | 1.25 |
| **Chlorpromazine HCl** | 2.5 | 0.79 | 0.75 | 0.73 | 0.69 | 0.65 | 0.59 |
| **Metoclopramide HCl** | 2.0 | 0.61 | 0.61 | 0.63 | 0.65 | 0.66 | 0.71 |
| **Promethazine HCl** | 1.0 | 0.77 | 0.75 | 0.74 | 0.71 | 0.69 | 0.65 |
| **Diethylperazine maleate** | 10.0 | 0.57 | 0.55 | 0.50 | 0.46 | 0.42 | 0.38 |
| **Trifluoroperazine HCl** | 2.0 | 0.62 | 0.57 | 0.53 | 0.45 | - | - |

Furthermore, it was seen that the sizes of spots were minimal on surfactant-impregnated plates when compared to spots on a plain silica gel plate. Surfactant impregnation reduced the development time as well as the tailing effect observed with diethylperazine maleate on a plain silica gel plate. The plausible mechanism of action of sodium lauryl sulfate is the formation of a complex involving the amino group of the drug and the surfactant. This might explain why sodium lauryl sulfate gave a better separation than polysorbate-80. Regression analysis of the linear curves obtained by plotting the $R_f$ value of each antiemetic drug versus concentration of sodium lauryl sulfate gave the following correlation coefficients : chlorpromazine HCl (0.9875); metoclopramide HCl (0.9475); promethazine HCl (0.9838); diethylperazine maleate (0.9910) and trifluoroperazine HCl (0.9886). As the effect on the separation of the antiemetics by polysorbate-80 impregnated silica gel was slight when compared to the plain silica gel, plotting the results was considered not necessary.

**Conclusion:** All the five antiemetics was best separated on silica gel impregnated with 1.25 % (w/v) sodium lauryl sulfate using iodine vapour as visualizing agent. Furthermore, it is hoped that sample matrix containing any mixture of the drugs could be analyzed by high performance liquid chromatography while using 1.25 % (w/v) sodium lauryl sulfate as an ion-pair reagent.

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