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Original Research Article

Application of a sensing device on paper to detect presence of loperamide in human saliva

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Abstract

Loperamide is a drug used most frequently and is effective against many types of diarrhea and also for reducing ileostomy output. There may be bioavailability of drug in saliva after ingestion which may be harmful. Therefore, it is necessary to detect the drug and thus to prevent side effect. The present study aims at developing a handy tool which even a layman can use. The tool has been prepared by impregnating a newly developed reagent system on TLC strip. When saliva sample containing loperamide is dropped on the prepared strip it provides us coloration according to the concentration of the drug. Thus the developed tool is suitable for point of care health check.

Key Words: Loperamide, diarrhea, handy tool, TLC, bioavailability.

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INTRODUCTION

Loperamide Hydrochloride is a white or almost white powder which is slightly soluble in water, freely soluble in alcohol and in methanol. It shows polymorphism. The chemical formulae for Loperamide Hydrochloride is $C_{29}H_{34}Cl_2N_2O_2$. Loperamide is a piperidine derivative[1], is a drug used against diarrhoea resulting from gastroenteritis or inflammatory bowel disease. It was developed by Janssen in 1971[2]. It was developed at Janssen Pharmaceutical[3]. It is on the World Health Organization's List of Essential Medicines, a list of the most important medication needed in a basic health system[4]. Loperamide is effective for the treatment of a number of types of diarrhea[5]. It is soluble in methanol and chloroform. Loperamide is a synthetic piperidine derivative, is an opioid drug effective against diarrhea resulting from gastroenteritis or inflammatory bowel disease. In most countries it is available generically and under brand names such as Lopex, Imodium, Dimor, Fortasec and Pepto Diarrhea Control. The determination of loperamide in pharmaceutical formulations and biological fluids has been described and reviewed[6]. About 70% of administered loperamide is absorbed in the gastrointestinal tract and thus suspected to be present in saliva.

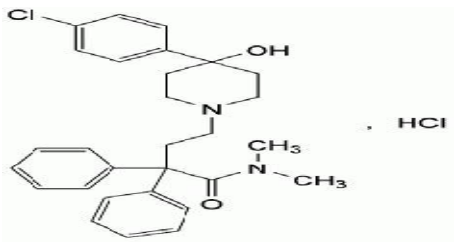

Figure 1:

Loperamide Experimental Work: Amlathe et al have developed a tool called paptode on paper platform by for many toxic entities[8-14]. Loperamide was determined spectrophotometrically/colorimetrically in bulk and marketed formulation by using Potassium bromide-bromate reagent in presence of HCl and crystal violet as dye. The same reagent system has been modified and utilized in the present study to develop the tool to detect the Loperamide in saliva.

Apparatus and software: The scanner (EPSON L210) was used for scanning the strips. Resolution of scanner: 300 dpi. MATLAB software.

Chemicals and Reagents: All reagents used were analytical grade chemicals. Double distilled water is used throughout the experiment.

Imodium (2mg): purchased from the local market.

Potassium iodide (KI): Potassium Iodate: 1:1 Soln.

Crystal Violet: 0.1% solution

Procedure:

Preparation of Handy Tool (Dipstick): The Dipsticks were constructed by immersing TLC strips in 1: 1 solution of KI: KIO_3 for few seconds and then dried in a

temperature controlled oven (to speed up drying) followed by immersing in 0.8% solution of crystal violet in an acidic medium and then dried again in an oven at the same temperature for 15 min. The prepared sticks were stored in cool and dry place and can be used for 25 days.

Mode of Operation: The tools (sticks) were dipped in the saliva samples collected from different persons. The dark dirty green coloration appears based on the concentration of loperamide on the immersed area. The developed color were scanned using a flatbed scanner and the obtained images have been transferred to computer for MATLAB assisted digital RGB analysis and the intensity of color-spots was recorded. Effective intensity for any color values of color spots was calculated by following formulae:

$\mathbf{A_r = -Log\ (R_s/R_b)}$ **_____(1);**

$\mathbf{A_g = -Log\ (G_s/G_b)}$ **_____(2);**

$\mathbf{A_b = -Log\ (B_s/B_b)}$ **_____(3);**

Where, A_r, A_g, A_b are effective intensities of red, green and blue color respectively ,R_s, G_s, B_s and R_b, G_b, B_b refer toR, G and B values of sample and blank respectively. The calibration curve is obtained by plotting effective intensities of R, G and B values vs. analyte concentration. Where; B- blank, S- sample, a- color development in solution, b- color development on injecting various concentration of analyted

RESULTS AND DISCUSSION

The prepared tool has been utilized to detect the presence of Loperamide as less as 0.05 µg/ml.

Table 1: Detection of Loperamide Quantity in Saliva Samples

Sr. No.	Sample	Loperamide originally found	Loperamide added	Total Loperamide Found	% recovery
1	Saliva (Sample 1)	Nil	10µg	11µg	110.0
2	Saliva (Sample 2)	Nil	20µg	20µg	100.0
3	Saliva (Sample 3)	Nil	30µg	30µg	100.0
4	Saliva (Sample 4)	Nil	40µg	41µg	102.5

The table shows that the observed samples of saliva had no loperamide concentration but the developed tool is efficient enough to trace the presence when added.

CONCLUSION

Loperamide is a medicine used frequently for gastroenteritis. Thus common man can be suspected to have its content left in saliva and thus can pose hazard to human. The developed tool was successfully applied to detect the presence of loperamide in saliva.

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