Adsorption Capacity of Nicotine From Tobacco Products By Different Adsorbents

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ABSTRACT:

This study determined the adsorption capacity of nicotine content of tobacco in four cigarettes brands . The method was used to estimate the nicotine in tobacco products by an Ultraviolet-Visible Spectrophotometer. The results for nicotine content that was adsorbed highest in coconut fibre and saw dust , followed by tea waste.

KEYWORDS: *UV-Vis Spectrophotometer, tobacco, nicotine, adsorption.*

I. INTRODUCTION

The highly toxic chemical in tobacco alkaloids is nicotine,3-(1-methyl-2-pyrrolidinyl) pyridine present in the leaves of *Nicotiana tabacum* **[1].** Nicotine is one of the several thousands of compounds , identified in tobacco . The determination of nicotine is an important analysis for the tobacco industry, as the quality and usability of the product can be determined by its nicotine content **[2]**. Nicotine content in cigarettes has been reported in several studies **[3-4]** based on the dose reduction resulting from cigarette smoke as the main control in estimating the concentration of nicotine produced by smoking . Nicotine can be found in tobacco particulate matter and in tobacco smoke **[5].** Nicotine in tobacco smoke is converted to its volatile and available free-base from through the action of gaseous ammonia **[6].**Various methods have been employed to determine the nicotine content in tobacco, including solvent extraction followed by gas-chromatographic-mass spectrometric analysis **[7]** or liquid chromatography with ultra violet visible (UV-Vis) spectrophotometer **[8]**. Most technologies are expensive . Activated carbons are widely used as adsorbents for purification of aqueous solutions . In separation science the process of adsorption has an edge over other methods ,due to its simplicity and sludge free clean operation used for nicotine separation **[9]**. The objective of this study is to estimate the nicotine content of 4 popular cigarettes and to compare the ability of coconut fibre , saw dust and tea waste as adsorbents for nicotine content in tobacco .

II. MATERIALS & METHODS

Brand of cigarettes used in this study were Gold, Capstan , Gudang garam and Tradition purchased from a local supermarket. Cigarettes were taken out of their rolling paper dried to weighing. 0.5g of individual tobacco were weighed, placed in a 100 ml beaker and treated with boiling water in a well-closed flask, after twenty-four hours the liquid was treated with 10 ml of adsorbing solution (0.01 NaOH in 10% ethanol) . Subsequently solution of nicotine extract was stirred for 3 hours . The liberated solution of nicotine is distilled off in a current of steam, in such a way that the volume of liquid in the flask is reduced 3/ 4^{rth} th . to $2/3^{rd}$. When the volume of distillate attains two to three times less then that of the original liquid the distillation was stopped.

III. RESULTS AND DISCUSSION

The results obtained in the estimation of nicotine adsorption of four cigarettes brands by coconut fibre , saw dust and tea waste,used as adsorbents were determinated by the UV-Vis spectrophotometer method. The data of the table(1) envisages that, the initial concentration of nicotine in four cigarettes Gold , Capstan , Gudang garam and Tradition were **$3.3106x10^{-3}$, $2.9867x10^{-3}$, $3.9196x10^{-3}$, $4.5351x10^{-3}$ mg/L** respectively, while the initial concentration of nicotinic acid that was used as standard was **$1.5031x10^{-3}$ mg/L .** The concentrations of nicotine in four cigarettes that adsorbed by coconut fibre , saw dust and tea waste is shown in the table :

Table 1 : Adsorption of Nicotine of cigarettes in mg/L by the adsorbents.

cigarette	Coconut fibre		Saw dust		Tea waste	
	C_f	C_{ad}	C_f	C_{ad}	C_{final}	C_{ad}
Gold	$1.1143x10^{-3}$	$2.1963x10^{-3}$	$1.3022x10^{-3}$	$2.0084x10^{-3}$	$2.2805x10^{-3}$	$1.0301x10^{-3}$
Capstan	$0.7774x10^{-3}$	$2.2092x10^{-3}$	$0.9912x10^{-3}$	$1.9954x10^{-3}$	$1..8788x10^{-3}$	$1.1079x10^{-3}$
Gudang garam	$1.0431x10^{-3}$	$2.8765x10^{-3}$	$1.3735x10^{-3}$	$2.5461x10^{-3}$	$2.0149x10^{-3}$	$1.9047x10^{-3}$
Tradition	$1.1662x10^{-3}$	$2.5980x10^{-3}$	$1.9242x10^{-3}$	$2.6109x10^{-3}$	$3.7642x10^{-3}$	$0.7709x10^{-3}$
Nicotinic acid	$1.9371x10^{-3}$	$0.3379x10^{-3}$	$1.1337x10^{-3}$	$0.3694x10^{-3}$	$1.9371x10^{-3}$	$0.1296x10^{-3}$

Where C_f = The final concentration of nicotine in equilibrium.

C_{ad} = The concentration of adsorbed nicotine by adsorbents.

Adsorption of nicotine was measured at specified time using three adsorbents like coconut fibre , saw dust and waste tea leaves for four different cigarettes . From Fig **1** to **3** the plot reveals that the amount of nicotine removed by coconut fibre and saw dust were higher, then the amount of nicotine was removed by using waste tea leaves .The result showed that coconut fibre and saw dust had more efficiency than waste tea leaves as adsorbents to remove nicotine in cigarettes . Therefore active carbon fibres of coconut with unmatchable pore structure and surface characteristics that have materials and high efficiency for a number of application, these organic materials can be used for adsorption of wide number of molecules of organic matter as observed by Manocha **[10]**.

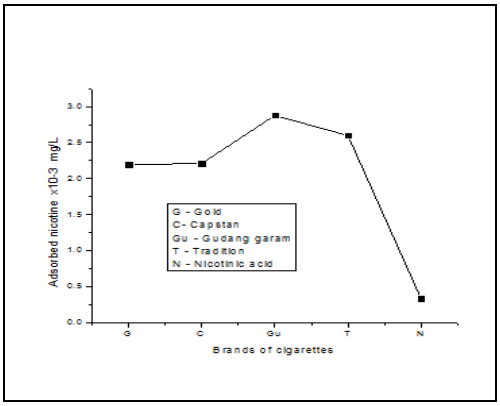

Figure 1 : The nicotine adsorption capacity of four cigarettes by coconut fibre

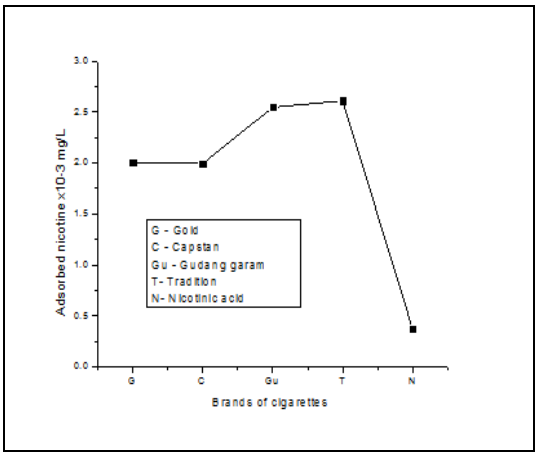

Figure 2 : The nicotine adsorption capacity of four cigarettes by saw dust.

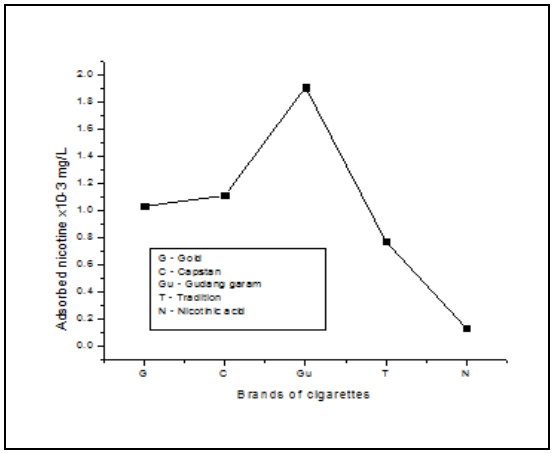

Figure 3 : The nicotine adsorption capacity of four cigarettes by tea waste.

The above figures showed that the amount of adsorbed nicotine by coconut fibre and saw dust was higher in Gudang garam than Tradition, Capstan and Gold respectively, while the amount of adsorbed nicotine by tea waste was higher in Gudang garam than Capstan , Gold and Tradition respectively. Therefore the percentage of nicotine was higher in Gudang garam than the other studied cigarettes .

IV. CONCLUSION

In the current study the nicotine content of tobacco in 4 popular brands of cigarettes was determined by using UV-Vis spectrophotometer after using different adsorbents. The results showed that the concentration of nicotine that adsorbed by coconut fibre and saw dust was higher than the concentration of nicotine that adsorbed by tea waste. The coconut fibre and saw dust had higher efficiency as adsorbents in respect to nicotine adsorption .

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