

# Optimization of Cu (II) and Cr (VI) Removal Efficiency using ANNs and RSM

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## Abstract

The normal water great issues emerge from overwhelming metals in squander water emerging from the contemporary wearing activities. This studies come to be proposed to dispense with massive metals, for example, chromium and copper from fluid preparations through manner of adsorption utilising savvy and eco agreeable substances (nine). The expulsion effectiveness of Cu (II) and Cr(VI) in a twofold affiliation from squander water making use of Pumpkin strips has been examined. Studies had been led making use of bunch learns at pH 6 and room temperature regarding contact time and adsorbent element. The adsorption information have been suited for various ANNs models FFBP, GR, Cascade and Elman simply as to reaction surface version for the paired association. FFBP become the first-rate model ( $R^2=zero.99$ ) for chromium and for RSM with  $R^2$  values for Cu (II) 0.Ninety six, Cr (VI) 0.Ninety eight personally. Increment in adsorption portion became seen inside the adsorption concerning the trial paintings signified thus surface version (RSM). The results examined that Pumpkin strips maintain splendid capability ultimately of metallic particles from contemporary effluents.

**Keywords;** Adsorption, Copper, Chromium, Pumpkin strips, ANNs, RSM.

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## I. INTRODUCTION

Substantial steel loaded wastewaters are surprisingly dangerous, non-biodegradable, and most cancers-inflicting [10], [11], [13]. The pace of overwhelming metal releases are increasing grade by grade on account of exceptional mechanical sporting activities [2] which result in herbal debasement [10]. As a cosequence, the character of water and the photosynthetic interest are influenced to a huge quantity. Hence it is important to treat the waste water earlier than it's far discharged [8], [11] in to the water our bodies.

Copper is one of maximum drastically carried out overwhelming metal on the planet and it's far commonly deadly to the residing beings and the earth. Broad ingestion of Cu (II) can set off excessive affects like retching, problems, seizures and ceaseless nicely-being impacts like hemolysis,

nephro deadly influences or maybe passing. The improved stages of copper in condition constitute a stressful health threat to the humankind. According to WHO consuming water gauges, restrict for Copper is 0.05mg/L as and moreover 0.05 mg/L [3] consistent with ISI recommended limits, 1993. Chromium utilized in fabric ventures is highly risky and receives aggregated in the residing existence paperwork [12].

The big use of Chromium has delivered approximately lethal impacts, for instance, carcinogenesis [1], mutagenesis and teratogenesis [10] that's the result of bioaccumulation [12]. Different techniques were implemented for the treatment of inflamed water which incorporates Chemical precipitation, Ion trade, Membrane filtration, Electrochemical treatment, Coagulation and flocculation adsorption enhancements,

dissolvable extraction, switch assimilation [4], [8],[17]. In the continuing years, adsorption have become started to be the a achievement technique [1], [8], [13] for the treatment of present day waste water loaded down with massive metals. A widespread assortment of minimum attempt adsorbents, for instance, olive stones [4], sewage slop [6], tea leaves [7], Plant stem [3], avocado seeds [8], Agricultural squanders [12], were used by a few inquires about for the expulsion of overwhelming metals from cutting-edge waste water.

The greater a part of the multivariate techniques that were utilized for streamlining were counterfeit neural device (ANN) and response surface method (RSM).The RSM structures had been implemented to relate the pains and the comparing fits and to advocate assessment of the version for correctly approval. [15], [18].

## II. MATERIALS AND METHODS

### A. Pumpkin Peel powder

The Pumpkin strips had been accrued from one-of-a-kind vegetable markets in Chennai, India. The so amassed examples had been wiped easy, washed with delicate water a few instances and in a while solar-dried for an afternoon. From there on, the strips have been variety dried at 50o C over night time. The definitely dried Pumpkin strips were pummeled into powder, trailed by sieving to molecule size <425  $\mu\text{m}$  and put away in constant holders for capability use.

### B. Preparation of Adsorbate

The Stock arrangements of 1000 ppm for Cu(II) and Cr(VI) have been set up with the aid of using dissolving  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  protected 1000 ml deionized water in measuring glass. PH modified into modified according with  $6.5 \pm 0.5$  with the help of reagents, Hcl and NaOH. The centralizations of chromium and copper

at the same time as remedy were controlled via way of UV/VIS Spectrophotometer.

### C. Batch mode adsorption contemplates

Bunch mode adsorption reads were finished for a metallic mixture in a twofold association comprising of Cu(II) and Cr(VI). Tests were finished at room temperature to analyze the effect of two parameters explicitly the adsorbent detail and the contact time preserving pH constant. A trendy grouping of five mg/L became set up with the aid of using appropriate weakening of the stock solutions for each the metallic debris. A hundred ml check preparations. A 250mL area preserving the adsorbate and adsorbent was organized and unsettled at 180 rpm by using the usage of adjusting the a part of the adsorbent from 0.5 gm to one.Five gm and the examples have been expected at specific time interims jogging from 30 min to a hundred and 80 min. The adsorbate association changed into separated utilizing WhatmanNo.1 channel paper.

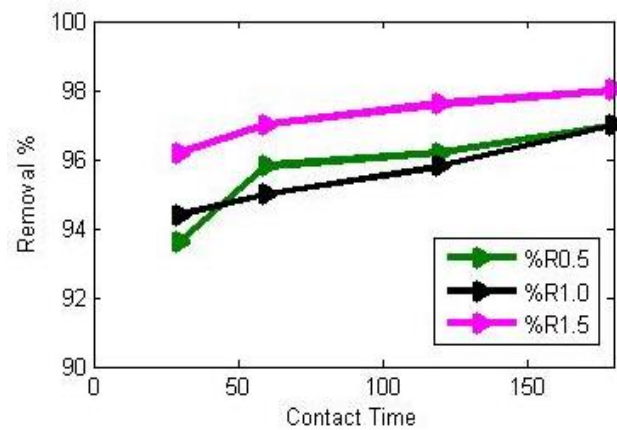
## III. RESULTS AND DISCUSSION

### A. Effect of Contact Time, Adsorbent Dosage

The expulsion % of the metal particles had been concentrated concerning the contact time on the overpowering metals utilising pumpkin strip powder due to the fact the adsorbent at pH an of 6.Five with three adsorbent doses zero.Five gm, 1.0 gm and 1.Five gm, in my view. The expulsion % of the metallic debris had been centered concerning the adsorbent measurements on the overpowering metals using pumpkin strip powder due to the fact the adsorbent at pH an of 6.5 for distinct touch times 30,60,ninety,one hundred and twenty,one hundred eighty mins, in my view. The subtleties are seeded in Table I.

**Table I**  
**EXPERIMENTAL REMOVAL% FOR Cu(II)**  
**and Cr(VI)**

Metal ion	Co	Contact Time	Mass of adsorbent (gm)	Experimental %R
Cu(II)	5	30	0.5	93.6
	5	60	0.5	95.8
	5	120	0.5	96.2
	5	180	0.5	97
	5	30	1	94.4
	5	60	1	95
	5	120	1	95.8
	5	180	1	97
	5	30	1.5	96.2
	5	60	1.5	97
	5	120	1.5	97.6
	5	180	1.5	98
Cr(VI)	5	30	0.5	94
	5	60	0.5	96
	5	120	0.5	96.4
	5	180	0.5	97.2
	5	30	1	94.8
	5	60	1	97
	5	120	1	97.6
	5	180	1	98.2
	5	30	1.5	95.8
	5	60	1.5	96.8
	5	120	1.5	97.2
	5	180	1.5	97.8



**b)**

**Fig.1 Contact time Vs Removal % for Adsorbent dosages 0.5 gm,1.0 gm and 1.5 gms for a) Cu(II), b) Cr(VI)**

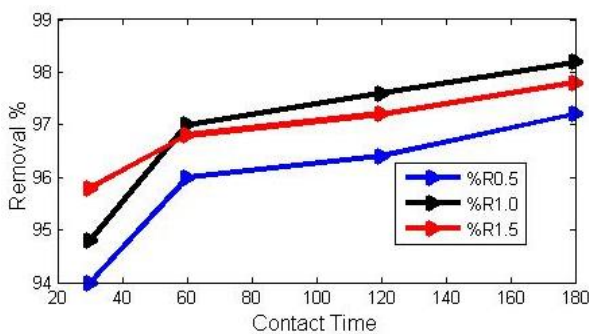
A. Effect of Contact time, Adsorbent Dose on Expulsion % utilizing RSM

B. Reaction surface system (RSM) additionally was utilized to examine and investigate the expulsion % of the metal particles in the watery arrangements. It was seen from figure.1 that as the adsorbent portion is expanded, the expulsion % expanded at a contact time of 30 minutes for Cu (II) just as for Cr(VI), individually.

C. Table II represents 4 system models Forward input spread, Generalized relapse, Cascade forward back engendering and Elman back proliferation were utilized to consider the relapse and the decency of fits were plotted for assessing the best model with least RMS mistake as appeared in Figure.2.

**TABLE II Comparison of ANNs and RSM for Cu(II) and Cr(VI)**

ANNs	Cu(II)		Cr(VI)	
	RMSE	R <sup>2</sup>	RMSE	R <sup>2</sup>
FFBP	0.2451	0.9750	0.0001	0.9999
GR	0.0123	0.9986	0.7854	0.8801
Casacade	0.7831	0.9390	0.0125	0.9999
Elman	0.0145	0.9976	0.3145	0.9005
RSM	0.4559	0.9669	0.286	0.9855



**a)**

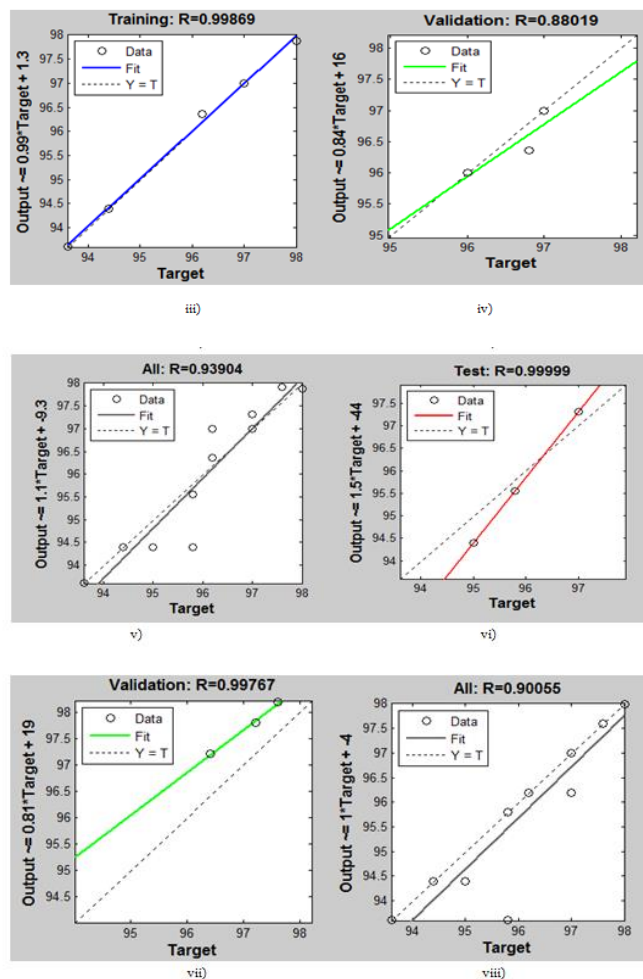
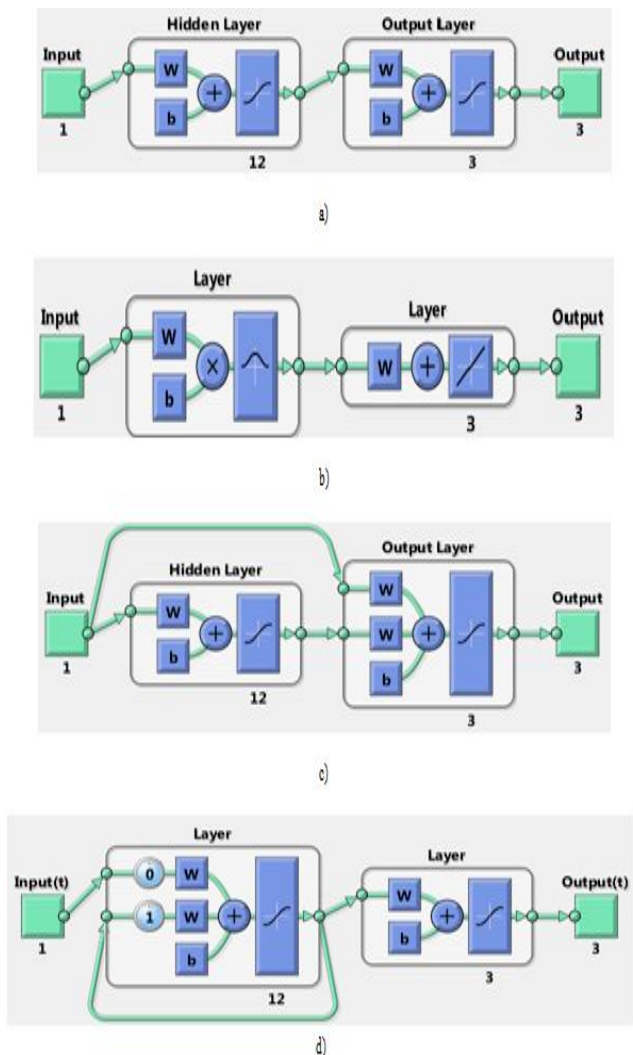


Fig.1 a) FFBP b) GR c) Cascade d) Elman models in ANNs training for Cu(II) and Cr(VI)

Fig. 3 Regression plots for FFBP-i), ii), GR -iii), iv), Cascade-v), vi), Elman-vii), viii) ANNs models for Cu(II) and Cr(VI)

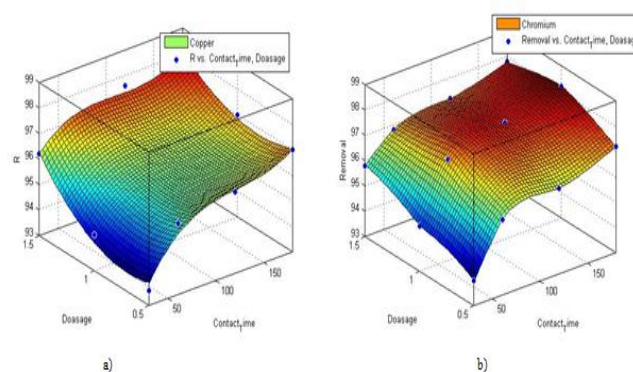
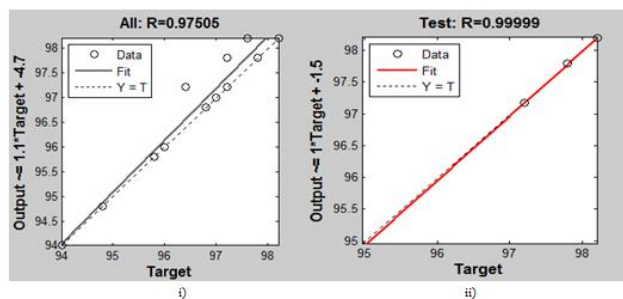


Fig. 3 Response surface models for Contact Time, Dose of adsorbent and Removal % for a) Cu(II) and Cr(VI)

#### IV. CONCLUSION

The disposal of Cu (II) and Cr(VI) from parallel association the use of Pumpkin strips has been tested at pH 6.5 regarding contact time and adsorbent element. The ideal expulsion for copper have become seen at 1. Five gm dose and for Chromium it turned into 1. Zero gm at a hundred and 80 minutes term using pumpkin strip powder as adsorbent. The relapse investigation for the adsorption facts modified into tested utilising ANNs using 4 models, FFBP, GR, Cascade and Elman fashions simply as response floor fashions. FFBP was the satisfactory version ( $R^2 = \text{zero.Ninety nine}$ ) for chromium and for RSM with  $R^2$  values for Cu (II) zero.Ninety six, Cr (VI) 0.98 for my part. The exhibition of ANNs changed into better than RSM concerning the relapse investigation. It is additionally seen that, there's a selection within the expulsion effectiveness with an increment inside the adsorbent portion for Cu (II) particle (98%) in the exploratory paintings and it's miles established obviously making use of reaction floor version. The effects indicated that Pumpkin strips preserve exceptional capability to expel steel particles from multi-phase cutting-edge effluents.

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