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Recycling of Dress-Cleaning Oil-Refuge

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ABSTRACT

On account of the market demand of the dress-cleaning oil, the study of the recycling of oil-refuge was carried out. Two new treatment materials viz. acid charred waste and pyro-char were used and the data obtained was compared with activated charcoal of commercial grade.

KEYWORDS

Oil-refuge , pyro-char, acid-charred waste, adsorbent, absorbance , suspended and soluble impurities,supernatant liquid.

INTRODUCTION

Dry cleaning is cleaning process used to clean fabrics that degrade in water, or some delicate fabrics that cannot withstand the rough tumble of washing machines. As the name implies, dry cleaning is not a 'dry' process, but clothes are soaked in solvent other than water.(1) Dry cleaning dates long back to the 18th century, when a petroleum-type solvent was spilled accidently on a greasy fabric and it was noticed that the stains disappeared when the solvent evaporated. Now a days the dry cleaning solvents used are turpentine spirits, camphor oil, naphtha, kerosene, white gasoline and benzene etc. According to one source , the average dry cleaner uses 12,000 gallons of white gasoline per year..(2) which is a substantial amount and nearly 25% of the dress-cleaning oil which is a petroleum product has to be rejected after its usage in the dry-cleaning process. It will be most beneficial and economical to proceed this waste for reuse for the dress-cleaning purpose.

The chief components of the oil refuge have been found to be as follows:

1.The suspended or sedimented residues mostly consisting of fiber and dust particles which are dislodged from the dress surface during cleaning operation.

2. Fatty oil and grease fractions which are also dislodged from fiber surface.

3. The soluble impurities which are extracted out of the fibers and which impart intense color to the oil. The recycling process of the above components in the oil-refuge ,by suitable physio-chemical process.

MATERIALS AND METHODS

Sample Collection:

Samples of well shaken dress-cleaning oil refuge (approx 3 liters) was collected from major dress-cleaning shops located in the mid town of Raipur city.

EXPERIMENTAL PROCEDURE

Determination of impurities

(1) **Suspended/Sedimented matter** :

A well shaken aliquot of sample (100ml) was kept overnight to allow it to settle. The supernatant liquid was decanted off, and sedimented matter was heated in an oven at 150 C for 3 hours. The residue was weighed after cooling.

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(2) **Fatty oil and Grease:**

The supernatant liquid was placed in a separating funnel with 30ml of Freon, and shaken vigorously for two minutes. The Freon layer was then drained into a weighed flask and distilled at 70° C. The flask was then steam heated, cooled and weighed. The increase in weight was taken as total oil and grease (fatty and non-fatty). The determination was repeated by taking the same aliquot of the sample and adding to it 10g of silica Gel 'G' (chromatography grade) to absorb the fraction of the fatty oil and grease. After extraction with Freon, separation and distillation, the weight was recorded, The residue represented the non-fatty fraction of oil and grease (3). The difference in values obtained from the two determinations was taken as fatty oil and grease.

(3) **Soluble coloured impurities :**

The clear sample of the oil-refuge was obtained by the sedimentation and centrifugation processes. The spectrum of clear oil was obtained using spectrophotometer (Systronic Model 301). A fresh and unused sample of solvent oil was used as blank. The spectrum obtained is shown in Fig I. and the results obtained have shown in Table 1.

Table-1 Impureties in Dress-Cleaning Oil.

S.No	Components	Concentration
1	Solid Residue	53.41g/l
2	Fatty-Oil and grease	3.6g/l
3	Coloured Impurities	Max.abs. =0.68 After 1:4 dilution at 507nm)

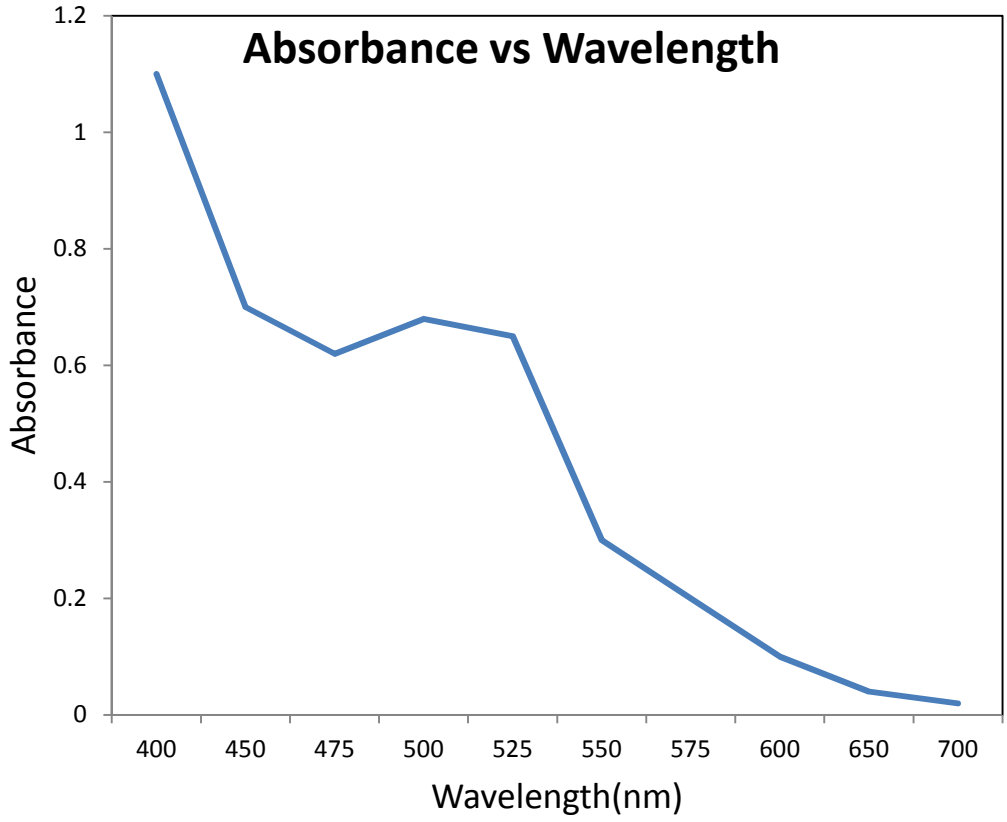

Fig-1 Spectra of untreated clear oil

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TREATABILITY STUDIES

Based on the results shown in Table-1 treatability studies of the oil-refuge was carried out as described below

(a) Removal of suspended Impurities: An aliquot (500ml) of the oil-refuge was allowed to settle overnight, the residue was rejected and the clear supernatant oil was used as follows.

(b)Removal of Dissolved Impurities : Three treatment mixtures were prepared as follows :

(i) Clear oil (100ml) + Charred-Waste of oxalic acid manufacturing plant (10g)

(ii) Clear oil (100ml) + Pyro-Char (10g)

(iii) Clear oil (100ml) + Activated charcoal (10g)

(iv) A blank containing only clear oil.

The removal of colored impurities in the three mixtures were monitored using a recording UV/VIS spectrophotometer (Varian Model DMF 100) at the wavelength of maximum absorbance (507nm). The spectra in visible range (351-700 nm) of the treated samples and also of the untreated blank are shown in Fig-2.

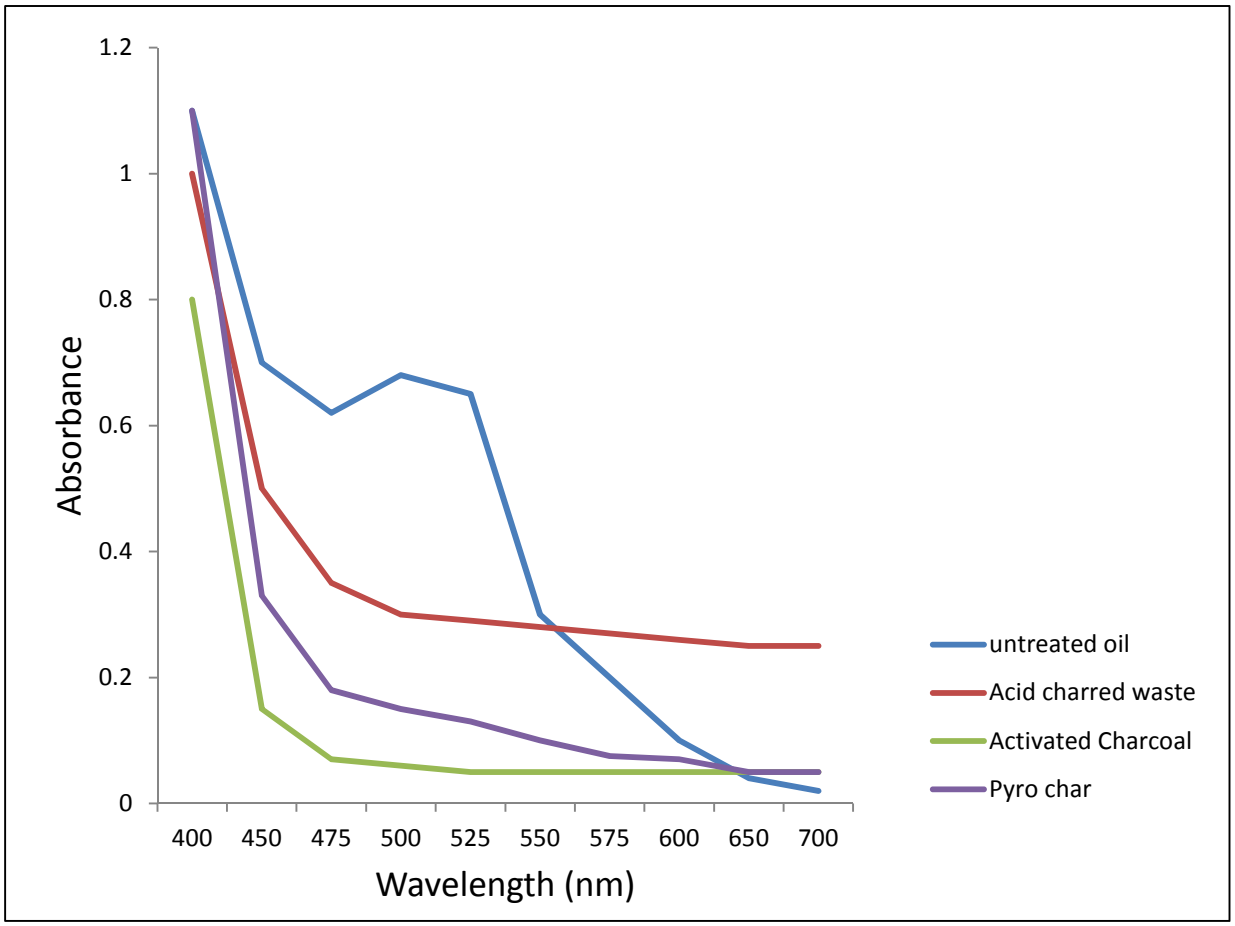

Fig-2 Spectra of Treated samples and blank

(c)Removal of Residual Colourless Soluble Impurities : It was observed that a faint color due to unadsorbed soluble impurities still persisted in all the three treatment mixtures. For removal of these 100ml aliquots of treated oil were mixed separately with 1g silica gel 'G' (chromatographic grade) and kept overnight. The oil samples can be kept with silica gel for a longer period but here it was kept for 24 hrs only. The spectra of finally treated oil samples were recorded and shown in Fig-3.

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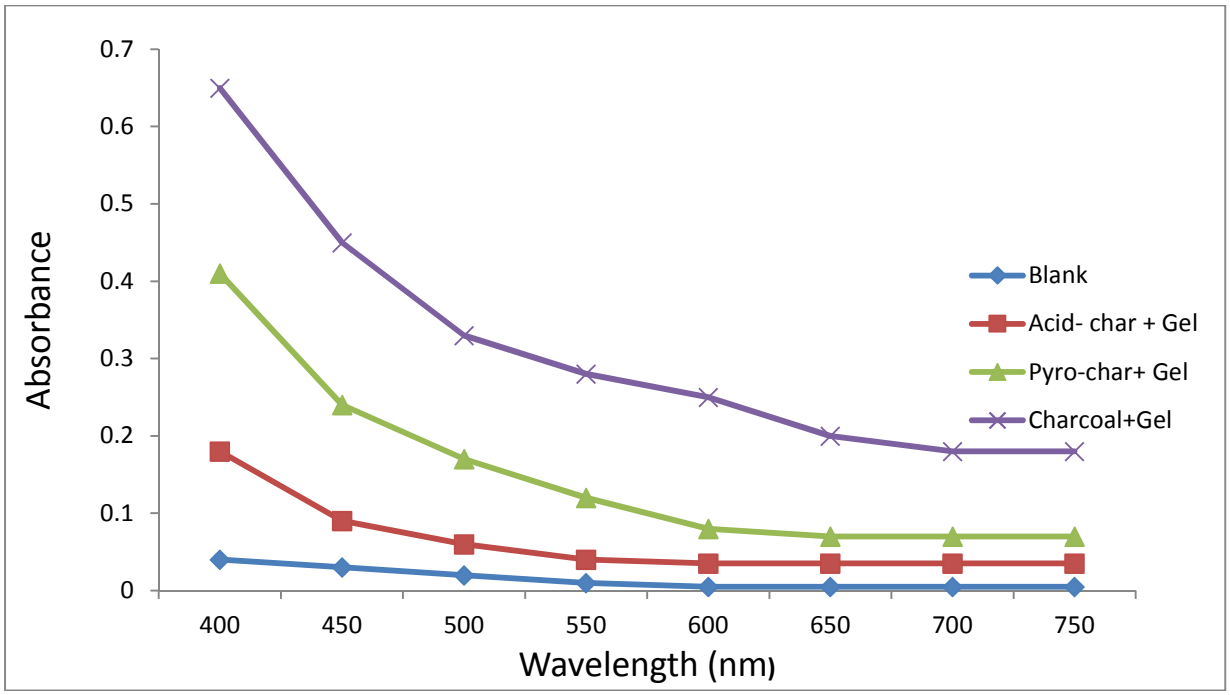

Fig-3 Spectra of finally treated oil samples.

RESULTS AND DISCUSSION

The oil-refuge of dress-cleaning shops is heavily loaded with soluble and insoluble impurities. Insoluble impurities were removed by sedimentation. For the removal of soluble and colored impurities researchers have been using innovative and inexpensive materials (4) , Ahmaruzzaman etal has been using rice husk ash as an adsorbent for the removing pollutants from water and wastewaters.(5) . Venkateswar etal has investigated use of Neem leaf powder as adsorbent (6). Méndez etal used pyro-char obtained from a paper mill waste (7) and Ramtake etal used distillery waste.(8)

Acid charred waste of an oxalic acid manufacturing plant (9) and pyro-char from paper mill waste which are inexpensive and abundantly available were investigated as adsorbent and their performance was compared with commercially available activated charcoal .The percentage removal of colored impurities by the three treatment materials has been shown in Table-2.

Table-2 The treatments and % removal of soluble impurities

S.No	Treatment material	%Removal
1.	Charred waste of oxalic acid manufacturing Plant	47.5%
2.	Pyro-char	75.0%
3.	Activated Charcoal	91.7%

The removal of the residual presence of impurities was done using the silica gel'G'.The percentage of removal is shown in Table-3

Table-3 Effect of the silica gel treatment

S.No	Details of treatment	%Removal
1.	Acid-char treatment+gel treatment	95.95%
2.	Pyro-char treatment+gel treatment	94.29%
3.	Charcoal treatment+gel treatment	92.30%

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CONCLUSION

It is concluded that the dress-cleaning oil-refuge can be recycled for reuse by following any of the above stated methods depending on the availability of the treatment materials and the extent of refining required. It has been found after investigation that Acid –charred waste of oxalic acid manufacturing plant can be used as low cost adsorbent very effectively**.**

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