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OPTIMIZATION OF VARIOUS PARAMETERS RELATED TO GLASS SCRATCHES REMOVING CHEMICAL COMPOSITION

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ABSTRACT

*Glass is a common material in a world who's daily uses are in every person's life, is given by some simple examples like drinking vessels, insulation, windows, displays and optical fibers. By modified the glass surface it is possible to change the performance of the entire glass object, generally known as Surface Engineering. In my work a new efficient algorithm is used to remove mark and scratches with the help of composition of chemicals. Glass scratch and repair has been revolutionized with innovative techniques specially designed to meet our needs. Several glass scratches and or damaged glass due to mineral deposits can now be removed with composition of chemicals. Scratches on auto glass, window glass, glass furniture, glass door and innovative construction scratches glass can now be repaired with the help of composition of chemicals. Glass manufacturers, construction developers, property maintenance establishments and any independent technician can remove unwanted glass scratches and glass damage efficiently and effectively. Grey based Taguchi methodology was adopted to achieve the said objectives. Three factors L- 9 orthogonal array was used to plan the experiments with each of 27 experiments conducted twice. A chemical composition was used to conduct the experiments. Width of the scratches can be remove with the help of the chemical composition on the glass jar or beaker and also to see the width of scratch remove with the help of microscope and time is to be calculated with the help of stop watch. S/N ratios and grey relational coefficients of width and time period were separately calculated, optimal setting of control parameters and finally the expected single valued grey relational grade was calculated whose value was 0.7. Confirmation experiments under optimal setting of control parameters were conducted to verify the expected value of grey relational grade which was found out to be **0.7**. Rubbing Alcohol with 66.15 % contribution was the most significant factors followed by Bug Spray with 07.90 % and salt with 0.09% contribution using ANOVA. It was thus clear that all of these factors have significant contributions towards the two performance characteristics.*

Key words: Width and Time period of scratch removal process, Grey based Taguchi method, Orthogonal Arrays, ANOVA, S/N Ratio, Normalized S/N Ratio

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1. INTRODUCTION

As we know that for the removing of various types of scratches and marks there are various method and also various techniques for the removing action of scratches over a glass surfaces.

Also for different types of glass there are different types of effects are seen in them. Our aim is to minimizes the deep scratches and remove also the normal scratches from glasses like as window glass of cars which are more effected the person while drive the car at night time. The light which are reflected from front viewer can problem created at the drive time of the car. So, here we can use basically three things i.e.; rubbing alcohol, Bug spray and salt. The various properties are explain below.

1.1. Rubbing Alcohol

Isopropyl alcohol is also known as rubbing alcohol. It is an alcoholic mixture use for external purpose such as an antiseptic. It contains 70% by volume of absolute alcohol; the remaining consists of water, denaturants, and perfume oils; used for external application that produces redness of the skin, muscle and joint aches.It dissolves a huge range of non-polar compounds. As compared to ethanol it evaporates rapidly, and is relatively non-toxic, compared to alternative solvents. So it is widely used as a solvent and as a cleaning fluid and especially for dissolving oils.Isopropyl Alcohol is also known as an Isopropanol. It is a chemical that's commonly found in rubbing alcohol, a product used as an alternative to washing the hands, and certain cleaning products. IPA (Isopropyl Alcohol) poisoning occurs when the liver is no longer able to manage the quantity of IPA in the body. IPA is a common chemical that's found in many cleaning products. A large amount of IPA is absorb, IPA poisoning can occur.Some of the most serious symptoms of IPA poisoning include slowed breathing, having a whirling sensation, and coma.

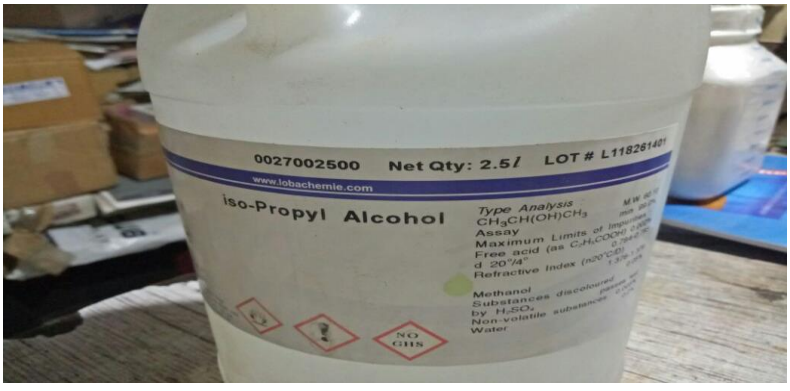

Figure 1 Rubbing alcohol

1.2. Bug Spray

A bug spray is a substance that applied to skin, clothing, or other surfaces which cause to lose confidence of insects from landing or climbing on that surface. Its help to prevent and control

the outbreak of insect-borne diseases such as malaria, Lyme disease, dengue fever, plague, fever etc.

2. LITERATURE REVIEW

Darwish S.M.H, Ahmed N. et al. (2017) Laser beam machining (LBM) has proven its applications and advantages over almost all the range of engineering materials. It offers its competences from macro machining to micro and nano-machining of simple-to-complex shapes. The hybrid approaches in laser ablation have demonstrated much improved results in terms of material removal rate, surface integrity, geometrical tolerances, thermal damage, metallurgical alterations and many more.

Jenkins P. and Yang Liu (2016) This paper reviews theavailable knowledge of the thermally-induced strength loss in glass fibers, discusses some of the phenomenon that are presents the status of research into processes to generate the strength and the value of such weak recycled glass fibers.

Rakesh B. Prajapati et al. (2014) studied the effects of process parameters like welding current, welding voltage, gas flow rate and welding speed in GMAW of AISI 1045 plates of 6 mm thickness on ultimate tensile strength of weld. To design and perform the experiment L25 orthogonal array (OA) is used. The inputs and corresponding outputs from these experiments were used to model an ANN using MATLAB to predict the ultimate tensile strength of welds. The results of validation tests using ANN were compared with that obtained by regression analysis and that obtained by experiments to identify the percentage of error. The maximum values of UTS obtained by ANN is 612.37 MPa with an optimum run set 220 Amp current, voltage 20.5 V, gas flow rate 15 l/min and 275 mm/min. This optimal combination set of input parameters uses for validation test.

Mohan A. and Poobal S. (2012) Based on the review, analysis is provided based on the image processing techniques, objectives, accuracy level, error level, and the image data sets. Finally, they present the various researchers to accomplish further research on crack detection.

3. EXPERIMENTAL SET UP

3.1. Preparation of Samples

In the study, each experiment was conducted twice and so for L9 OA, a total of 27 chemical compositions are prepared. The shape and size of the work pieces were selected so that after scratch removing, the specimen is as per the standard test specimen dimensions that are recommended for conducting standard scratch removing test on chemistry lab. The length of work piece that is glass which is to be taken are as 600mm, width of glass is 90mm and the thickness of the specimen is 10mm.

Each of the work pieces of the tests specimen was first kept at the stable position. Take a beaker generally glass beaker (here we take borosilicate glass) in which the different compositions of chemicals are taken. After that we mixed it properly with the help of stirrer. For keeping the composition of chemicals we take a plastic bottle. A few prepared chemical composition of bottle are shown in fig.2.

Figure 2 Rubbing alcohol

Table 1 Specifications of Rubbing Alcohol

Molecular Weight	60.10
Linear Formula	$(CH_3)_2CHOH$
Empirical Formula	C_3H_8O
Vapour Density	2.1(VS air)
Vapour Pressure	33 mmHg(20^0C) 44 mmHg(25^0C)
Auto ignition temp.	750^0F
Boiling Point	82^0C (lit.)
Melting Point	-89.5^0C (lit)

Table 2 Specifications of Salt

Product name	Sodium Chloride
Alternate name	Table Salt, Sea Salt, halite, Rock Salt
Chemical Formula	NaCl
Molecular Weight	58.44
Vapour Pressure	1.3hPa(865^0C)
Solubility in Water	358 g/l (20^0C)
Boiling Point	1461^0C
Melting Point	801^0C

Table 3 Different values of width and time after experiments

Exp. no.	**Rubbing Alcohol (in ml)**	**Bug Spray (in ml)**	**Salt (in grams)**	**Width (in mm)**	**Time (in minutes)**
1	1	1	1	0.050	57
2	1	2	2	0.051	61
3	1	3	3	0.053	64
4	2	1	2	0.069	53
5	2	2	3	0.068	55
6	2	3	1	0.071	57
7	3	1	3	0.100	42
8	3	2	1	0.091	43
9	3	3	2	0.079	45

3.2. Grey Based Taguchi Method

3.2.1. Select the Quality Characteristics

The selection of quality characteristics to measure as experimental output greatly influences the number of test that will have to be done to be statistically meaningful. Basically, quality characteristics that are variable in nature required substantially some tests than quality characteristics that are attributes in nature to get the same level of statistical significances. Here we have selected two performance characteristics – Width of the Penetrate or Scratches and Time.

3.2.2. Select Noise Factor and Control Factor

Noise factor are those things that a manufacturer cannot or wishes not to control for cost reason. Noise factor may be controlled temporally during an experiment. In this experiment control factor are the rubbing alcohol, bug spray and salt. Table 5.1 gives the control parameters with their levels.

Table 4 Control parameters and their levels

Control parameters	Level 1	Level 2	Level 3
Rubbing Alcohol	50	70	100
Bug Spray	20	30	40
Salt	10	20	30

Table 5 L9 Orthogonal array

	Column 1	Column 2	Column 5
S.No.	**Rubbing Alcohol (in ml)**	**Bug Spray (in ml)**	**Salt (in grams)**
1	50	20	10
2	50	30	20
3	50	40	30
4	70	20	20
5	70	30	30
6	70	40	10
7	100	20	30
8	100	30	10
9	100	40	20

Table 6 Width of the scratches and time of removal of scratches with their S/N ratios

S.No.	Rubbing Alcohol (in ml)	Bug Spray (in mm)	Salt (in grams)	Width (in mm)	Time (in minutes)	S/N ratio (Width)	S/N ratio (Time)
1	1	1	1	0.050	57	-26.02	35.11
2	1	2	2	0.051	61	-25.84	35.70
3	1	3	3	0.053	64	-25.51	36.12
4	2	1	2	0.069	53	-23.22	34.48
5	2	2	3	0.068	55	-23.34	34.80
6	2	3	1	0.071	57	-22.94	35.11
7	3	1	3	0.100	42	-20.00	32.46
8	3	2	1	0.091	43	-20.81	32.66
9	3	3	2	0.079	45	-22.04	33.06

Table 7 Normalized S/N ratios with Grey relational coefficients and Grey relational grades

S.No.	Normalized S/N ratio (Width)	Normalized S/N ratio (Time)	Grey relational coefficients		Grey relational grades
			Width (in mm)	Time (in minutes)	
1	0.00	0.68	1.00	0.42	0.71
2	0.02	0.86	0.96	0.36	0.66
3	0.06	1.00	0.89	0.33	0.61
4	0.38	0.50	0.56	0.50	0.53
5	0.36	0.59	0.58	0.45	0.51
6	0.42	0.68	0.54	0.42	0.48
7	1.00	0.00	0.33	1.00	0.66
8	0.82	0.04	0.37	0.92	0.64
9	0.58	0.13	0.46	0.79	0.62

4. RESULT AND DISCUSSION

Table 8 Response Table for Mean Grey Relational Grade

Factors	Level 1	Level 2	Level 3	Max. -Min.	Rank
Rubbing Alcohol (A)	0.66	0.50	0.64	0.16	1
Bug Spray (B)	0.63	0.60	0.57	0.06	2
Salt (C)	0.61	0.603	0.59	0.02	3

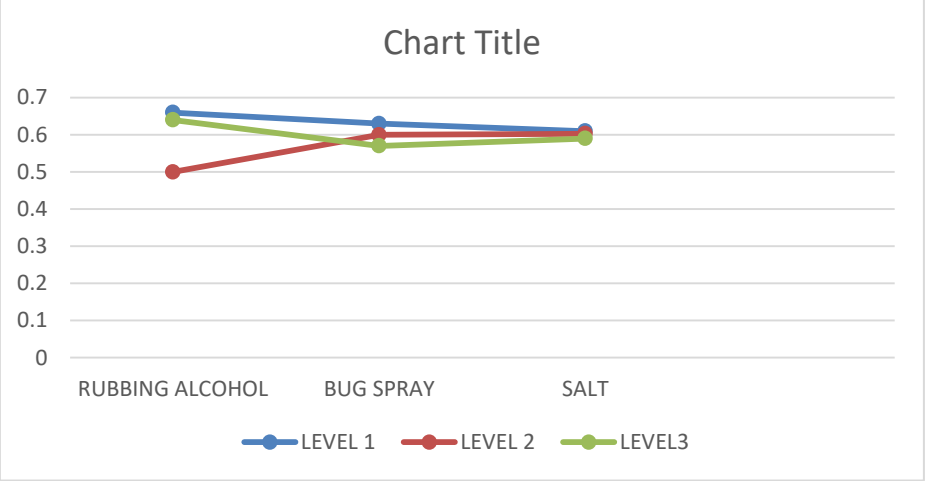

Figure 3 Response graph for the three factors

With the help of table 6 and fig. 7, the optimal factor combination is determined and for this study their setting is – A_1, B_1 and C_1.

Table 9 Results of ANOVA

Factors	DOF	S.S	M.S	Percentage Contribution
Rubbing Alcohol	2	0.045	0.0225	66.15
Bug Spray	2	0.0054	0.0027	07.90
Salt	2	0.00062	0.00031	0.09
Error	2	0.0170	0.0085	0.249
Total	8	0.06802	0.03401	

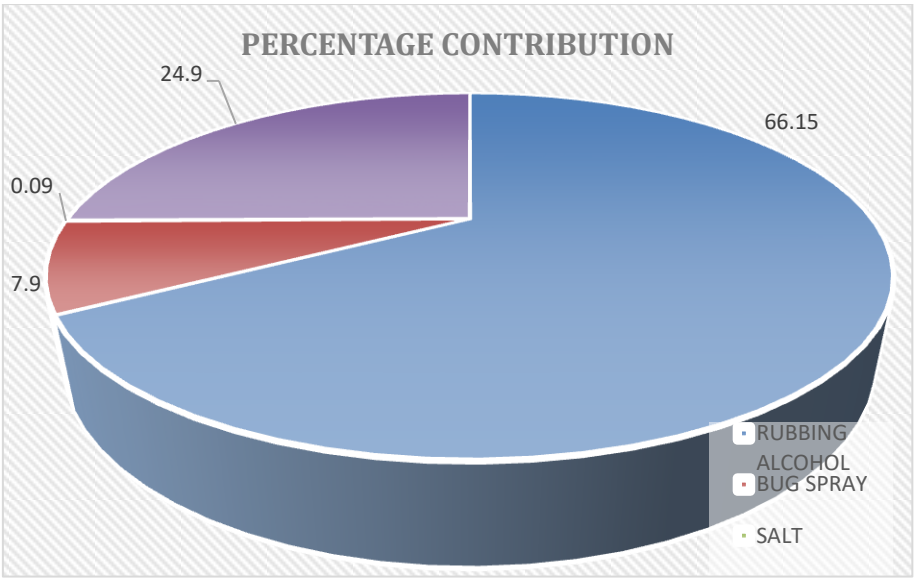

Figure 4 Percentage contribution of each factor

It is clear from ANOVA table that factor A i.e. Rubbing Alcohol is the most effective factor in the removing of scratches followed by factor B i.e. Bug Spray. Surprisingly, factor C (Salt) which is believed to be the most effective factor for removal of scratches. It means that the performance characteristics can be changed by a slight change in compositions the values of width and time will change by greater amount. Fig. 6.2 gives the graphical view of the percentage contribution by each factor towards the performance characteristics or significance of each factor.

5. CONCLUSIONS

Based on the Grey based Taguchi method, an optimal combination of parameters for maximum width of scratch remove and minimum time taken was predicted. The grey relational method was conducted and the calculated value of combined performance characteristic was found to be **0.7**

Following conclusions can be drawn for the present study:

- For a normal composition of any other substances like, paste is not much more effective. So, with the help of chemical composition of rubbing alcohol, bug spray and salt there are limited options of control parameters as well as on their levels as levels can be set at some particular discrete values only. Appropriate composition is required to good visibility otherwise the possibility of misinterpret factors dominating and causes dangerous.
- The test on glass surface must be performed in chemistry lab by using apron and hand gloves otherwise it may lead to armful.
- The other factors like various types of deep scratches, work plate (glass plate), chemical composition and environment may play an important role in modifying the results and so the present study can be considered as a preliminary study.
- At optimal settings the experimental values of performance characteristics are much higher and experimental grey relational grade**=0.7**was found close to that expected.
- Rubbing Alcohol was found to be the most significant factor with 66.15 % contribution, followed by Bug Spray with 07.90 % and lastly salt with 0.09 %. Thus none of the factors was insignificant in this study.

- Grey based Taguchi method is the most suitable method for offline quality tool when
- There are more than one performance characteristics. The accuracy of the results can be Improved by increasing the number of trials for each experiments, however increases the Cost of experiments and the time to conduct the trials.
- This study can be considered to be removal action of scratches as we have used a glass.

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