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Preparation of Rust Removing Kit For Its Removal From Ceramic And Heavy Machinery

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Abstract: Problem of rusting on the machines and heavy engineering machine setup in the industrial manufacturing plants of various companies is very common. Most of the machines in fabric dyeing companies ,chemical Plants ,leather tanneries, tool manufacturing units and gear manufacturing industries having the rust on them. When industrial machine setup becomes too old and due to the continuous interaction with chemicals like dyes, acids ,bases and bleaching agents and polluted waste water.This rust material increases rapidly on water supply pipelines, weight scales, water boilers and iron made heavy engineering machines. When it is not continuously monitored and controlled by the maintenance staff of the company. Other reasons of rapid rusting are release of acidic fumes and hot water vapours which rapidly corrodes and damages the outer and inner surfaces of machines. One of the most important reason of industrial rusting is exposure to atmospheric moisture during the production processes in the manufacturing plants.

Generally development and deposition of rust stains and rust on ceramic surfaces occurs when they are in close contact with rusted iron and water and oxygen which is universally present in the atmosphere everywhere. The rust spots becomes more and more stubborn due to its deposition on the same place for long time and continuous ignorance by us. Today ceramic items are available in the market in different material types like vinyl, porcelain, granite, marble and travertine. Due to the high water absorption capacity of ceramic and porcelain tiles and materials they are at more risk of having rust. Such type of rust stains may be removed very easily by applying the paste of slight acids and salts and then scrubbing the stains.

Keywords:- Tanneries,Rust stains, Bleaching agents, Heavy Engineering machines, acidic fumes,ceramic rust spots.

1. INTRODUCTION:-

Rusting of iron and metal corrosion is very common problem in the material's world. The problem originates due to the atmospheric oxidation of iron and other metal surfaces which are unpolished and unpainted in the presence of water, water vapors and atmospheric moisture. It is a very common problem everywhere not only in out homes but work places, bathrooms, boilers and industrial manufacturing plants. Chemically an oxide of iron which is reddish brown in color is rust which is formed by the reaction of iron and atmospheric moisture or water. Its chemical name is Hydrated Iron(III) oxide and is the final product of oxidation of iron and other corroded metals. Generally corrosion or rusting requires water and oxygen both to occur. Rust is also called as iron oxide and ferric oxide very commonly .Chemical equation of rusting is

$4\ Fe + 3O_2 + 6\ H_2O$ ----------> $4\ Fe(OH)_3$

Five factors are responsible for the rusting and rapid rusting of the metal surfaces which are;-

a. Aerosol particle deposition
b. Pollutants
c. Condensation ,dew and moisture
d. Relative Humidity
e. Atmospheric temperature.

Metallic Rusting;-Corrosion or rusting is not the common phenomenon for all the metals and some metals corrode very easily like Iron and its alloys, magnesium and aluminium because they are having the property of loosening of electrons from their outer surfaces. These metals are widely used everywhere due to their rigidness, cheap cost and easy availability. zinc and plain steel corrodes very fast in all metal salt solutions. The problem of rusting increases with the increase in Relative humidity and decrease in atmospheric temperature.

Ceramic Rusting:-However, Ceramic products are nonmetallic but it does not means that they can't rusted. Ceramic pots, porcelain basins, Bath tubs, ceramic tiles and washbasins may retains rust stains when they are in direct contact with rusted iron articles like iron almirah, iron rods below the washbasins for support, iron gate of bathrooms etc. Most of the ceramic materials are immune to corrosion but some ceramic items which are made of vinyl, porcelain, tiles, marble, endora and spar-tech etc.

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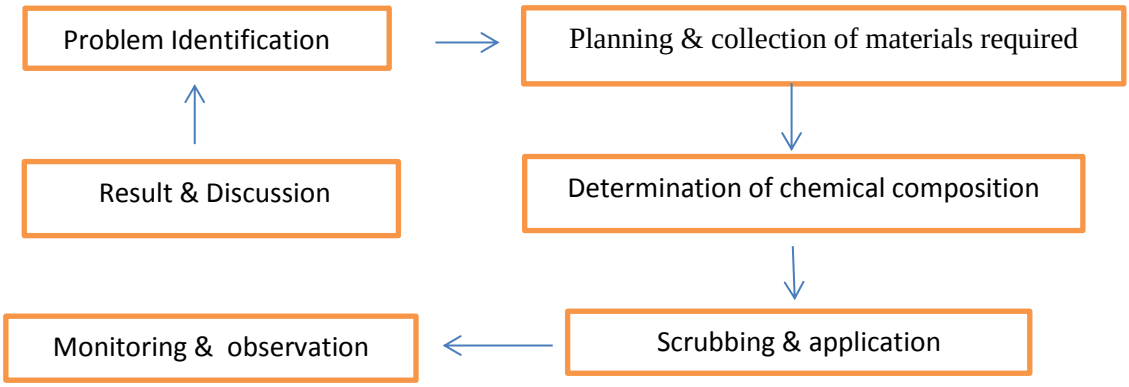
2. EXPERIMENTAL METHODS OR METHODOLOGY



1) Problem Identification:- Problem Identification and Problem description are the two most important steps in every research work and are beginning steps of research work. Without understanding and interpreting these steps we can't move further in the research field . First of all I have observed the problem of rusting and corrosion in the manufacturing units of textile industry ,fluorine products manufacturing industry and in the Leather tanneries. Same type of rusting & rust stain problem I found in scrap collection center of a well known ceramic company in Dewas district,MP.
In fabric dyeing plant I found rust on weight scale, border of dyeing tubs, techa dyeing machines etc.

2) Planning & collection of materials required:-
Planning and strategy making:- Planning and strategy making helps us to decide how we can best use our present available resources like – materials, equipments, information, money, time and people. I have planned for doing research work in this field of rusting solution or corrosion chemistry. In planning step I have reviewed the concerning literature/then searched the research gap which can be fill by my research work very easily.
Collection of materials/ equipments required:- I have collected all the essential chemical substances and equipments required for this research work like:-
Chemicals:- sodium hydrogen carbonate(baking soda), Vinegar, activated charcoal, old grape juice, lemon juice, salt.Musturd oil, petroleum jelly and glycerine and sand paper of 600 grade ,pH paper for chemical nature detection
Glasswares:-1 set petri-dish, beaker-250 ml(1), beaker-50 ml(1), stirrer, spatula, mortal & pastel, stirrer.
Equipments:- electronic weighing machine, Grinder, Stop watch.

3) Determination of chemical composition:- As I have prepared 3 different products/solution in my research work so I have decided the chemical composition of each product here according to law of constant proportion. Three different products I have prepared here are:-
1. Rust Scrubbing Paste (RSP) for metal surface scrubbing
2. Rust Scrubbing Suspension (RSS) for rust stain removal on ceramic surfaces.
3. Prevention Applicator Paste

i) Chemical composition determination of Rust Scrubbing Paste for metal surface scrubbing:- I have applied the knowledge of law of equivalent fractions while determine the composition of two main chemicals vinegar and baking soda in equal quantities by their mass ie-10 gms each. After that I have extracted out juice of old grapes by grinder and filter it and then weigh its 4gms quantity and 6gms of activated charcoal.Both ingredients I have added into the paste of baking soda and vinegar and stirred the whole content thoroughly Vinegar and $Na.HCo_3$ in equal amounts (1:1) and old grape juice & charcoal (in 2:3 ratio) in order to make 30 gms of RSP for Metal rust scrubbing.

ii) Photo of Rust Scrubbing Paste for Iron & metal surfaces.

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iii) Chemical composition determination of Rust Scrubbing Suspension for ceramic surface scrubbing: In order to prepare RSS for removing rust from outer surfaces of the ceramic items I have mixed 7 gms of salt with 7 gms of sodium hydrogen carbonate (taken equal quantity of reactants) and make a mixture in a separate petridish after that I have taken 24 gms of lemon juice(Citric acid) to it I have added 8 gms of vinegar and stirred well to make a solution of solvents.In this citric acid-vinegar solution I poured the mixture of sodium hydrogen Carbonate and NaCl.After the addition i mixed the whole composition by glass stirrer.After that I have added 4 gms of finely grinded activated charcoal in the suspension mixture and mix well the content .Finally I got a black colored liquid suspension which is slightly acidic in nature.

Ingredient	Quantity
NaCl	07 gms
$Na.H.Co_3$	07 gms
Vinegar	08 gms
Citric acid	24 gms
Activated charcoal	04 gms
Net weight	50 gms

In this preparation I have used citric acid as a main solvent because it is a very good clean and rust removing agent and it has 3 peak pH values in range of 3 to 6 on pH scale which indicates that it is a weak acid. Secondly I added vinegar to it which is also a weak acid because it has pH value in between 2.0 -3.0 and partially dissociates when added into the water.sodium hydrogen carbonate is an excellent scrubbing and cleaning agent for vitrified tiles and ceramic item surfaces.

I have added finely grinded activated charcoal in both the preparations i.e:- Rust Scrubbing Paste (RSP) for metal surfaces and Rust Scrubbing Suspension(RSS) for Ceramic surfaces because it is the best surface covering agent.There are many astounding benefits of using activated charcoal in these preparations as surface covering agent because one full tea spoon of activated charcoal has more surface area than a football pitch.It has pH value in the range of 9-11 on the pH scale. In case of ceramic rust stains Rust scrubbing suspension prepared is very effective, since it is made up of both the weak acids vinegar and citric acid it will not degrade and damage the quality of ceramic-wares.

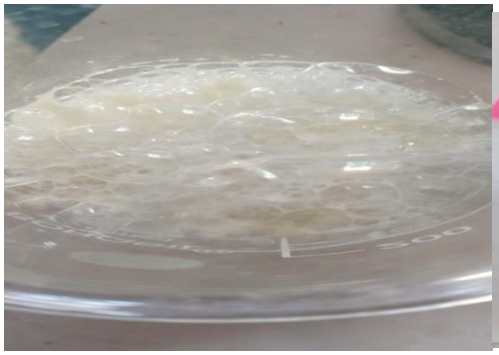

Photo showing large foam during the Productionof suspension

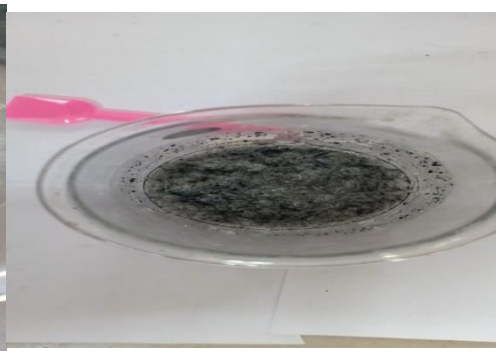

Photo showing the rust scrubbing suspension for ceramic rust removal

iv) Preparation of Prevention Applicator Paste:-It is a Preventive product and it will protect the unpolished and unpainted surface areas on iron articles and iron machines. I have made it by the combination of three chemicals ie:- glycerine, mustard oil and petroleum jelly. In the first step I have added 3 gms of glycerine with 3 gms of mustard oil (in equal amount) after that weighed petroleum jelly on electric balance in quantity of 6 gms and stirred well and finally I got a light yellow colored paste.

Use of petroleum jelly in Rust prevention paste:-

Petroleum jelly is used in the production of Prevention applicator paste is to increase the sustainability and fixing time of the paste on the metal surface at the rust place. I have used it in this chemical preparation because of its very high melting point. between the 40 -70 ^{0}C because it is typically a mixture of many hydrocarbons and it is soluble in mustard oil and glycerine mixture and it is insoluble in water(water proof) hence it is a very good fixative agent. concentration of petroleum jelly is 50% of the total weight of the prevention application paste.

pH detection test of Rust prevention paste;- By dipping a new teared pH paper strip in the paste I got the pH of the fixative paste to be 6.9 near to neutral value.

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Use of Glycerine:- It is a water hydraulic fluid and is very viscous and hence it is also a very good metal fixing and rust preventing agent.

Use of Mustard oil :- I have used it in the paste preparation as a solvent for the dissolution of petroleum jelly and mustard oil is a very good for corrosion prevention agent for cast iron and steel containers.

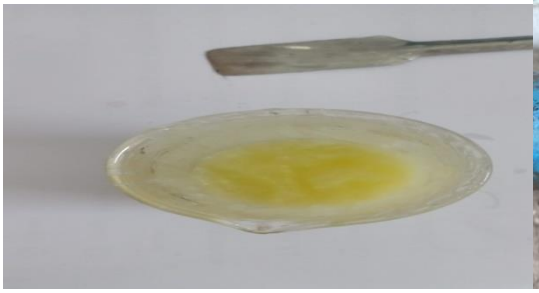

photo- Rust prevention paste for the metal surface

photo :- water supply Pipeline in chemical plant applied with rust prevention paste

4) Scrubbing and Application:- fourth step of my research methodology is application of the products prepared for removing rust from metal and ceramic surfaces.I have scrubbed the rusted metal surface area on iron machines, tools and pipelines by sand paper 600 grade and then rub that areas by rust scrubbing paste by the help of used toothbrush many times.

RESULTS AND DISCUSSION:-

I have observed that rust removed from the iron surface in a very less time. In support of this I am showing photos as evidence.

photo-rusted cover of industrial water Before treatment

photo clean cover of industrial water pump after treatment with RSP metals

Photo showing Rust deposition on company

Photo showing clean water supply pipeline in the water supply pipeline in company after treatment with scrubbing paste.

I have noticed that Rust scrubbing paste and Rust scrubbing Suspension effective in removing rust stains on metal and ceramic surfaces. Preparations found to be effective in removing rust and dust from surfaces in less time. Less quantity (5g/5ml) cleans surface in maximum 5 minutes. To test the harmless nature pH detection tests were also done in which preparations found to be safe with respect to surface and environment.

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photo heavy rust on Primer coated pipe photo – clean pipe of industrial shade after treatment rust scrubbing paste. of industrial shade

photo-rust stains on wash basin photo –showing clean washbasin

Photos(a) rust stains on vitrified tiles (b)during suspension wash (c) Clean bathroom tiles.

Monitoring & observation:-In the observation stage.

Table -1 Cleaning time of Rust Removers:-

Rust remover name	Quantity used	Time taken
Rust removing paste,RSP	5 gms/ sq feet	4-5 minutes
Rust Scrubbing suspension	5 ml/ sq. feet	2-3 minutes.

Both the rust removers have taken very less time and surface covering capacity found large.

Table-2 pH Detection Test-

Preparation name	pH Value	Chemical nature
Rust scrubbing paste	9.5	Slight basic
Rust scrubbing suspension	7.5	Mild basic
Prevention applicator paste	6.9	Near to neutral

CONCLUSION:-

.Finally after the preparation of these products and application on the rust deposits and stains I have drawn a conclusion that these are very effective in removal of rust in minimum time. Rust scrubbing paste and Rust Scrubbing Suspention both are good at cleaning action. Prevention applicator paste is better than greese and gives better results.

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