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METHOD OF CLEANING RAILWAY CARS AND THE LIKE

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The present invention is concerned with an improved method for washing railway cars and the like where the problem of streaking is encountered incidental to a washing operation.

In a typical railroad passenger car cleaning operation, the train is put through a series of cleaning facilities installed on both sides of a track, at a speed usually on the order of one foot per second. In the first section, the cars are sprayed with cold water for the purpose of cooling the surfaces and for filling the capillary crevices with water. After a period of about 1 to 3 minutes, i. e., a distance of about 60 to 180 feet farther along the track, an acid detergent may be applied, which detergent may include mixtures of materials such as oxalic acid, sodium acid sulfate, and various wetting agents. About 1 to 2 minutes after the application of the detergent, the cars are scrubbed down by motor driven, wetted brushes which contact the sides and the windows of the cars, scrubbing the detergent and the soil deposits.

Subsequently, the train passes through another water spray stand immediately ahead of another pair of motor driven brushes. In these two stages, the cars are rinsed and further scrubbed.

Within about 30 feet of the final scrubbing stand, the cars pass through a standard water spray stand which flood rinses the equipment by spraying tap water under pressure along the sides of the car.

The foregoing procedure is sometimes varied by including the step of spraying the cars with a mild alkaline detergent before the cars are subjected to the first brushing operation. In other cases, the detergent is applied in two stages, each of which is followed by a brushing and rinsing operation.

In still other cases the detergent solution is applied in two stages, the first of which is an acid detergent and after a lapse of time an alkaline detergent is applied followed by a brushing and rinsing operation.

This invention is also applicable to a system of car cleaning without the brushing operation. This process of washing is termed the "pressure system." By this method, the car surfaces are first sprayed with tap water for cooling, removing dust and loose soil, and for filling capillary crevices; then the detergent, either of the acid or alkaline type, is applied to the sides of the cars and the windows in the manner heretofore described. Thereafter instead of the brushing operation, a high pressure spray of tap water is applied to the sides of the car and the windows, which high pressure spray is effective in dislodging soil and deposits of any kind that are loosened or disbonded from the surface by the detergent, after which the high pressure jet action from the high pressure spray will dislodge and remove sediment, dirt or soil of any kind. After the high pressure spray operation, the car surfaces are subjected to the usual tap water flood rinse.

Regardless of the type of cleaning operation used, it has been found that the windows and the sides of the cars

become progressively coated with a film of residual foreign matter which results in a streaked appearance on the windows and the sides of the car. The problem is particularly acute during conditions of high temperature and low humidity, since such conditions favor the rapid evaporation of the rinse water, leaving a dry film on the windows and sides. The failure of the cleaning processes and materials presently employed for cleaning railway cars to eliminate the streaking and filming has required that the foregoing procedure be supplemented by a time consuming and expensive operation of hand wiping the windows and sides of the cars after the final rinsing. This single operation probably constitutes the most expensive portion of the entire car cleaning process. The elimination of the necessity for this final hand cleaning operation is the principal object of the present invention.

Another object of the invention is to provide a simple, but highly effective method for cleaning railway cars and the like in a completely automatic manner.

Another object of the invention is to provide a method for cleaning railway cars and the like without leaving streaks and/or films on the windows and sides of the cars, and doing so in a rapid and economical manner.

The process of the present invention, includes as one of its principal features the use of a demineralized water as a rinsing agent to remove previously deposited films which result from ordinary cleaning operations. More specifically, the demineralized water is applied to the roof, sides, and the windows of the railway cars after the cars are flood rinsed with ordinary tap water, the demineralized water being sprayed onto the cars just after the flood rinse water has been substantially drained off. It has been found that the demineralized water rinses effectively, redissolves deposited mineral matter left after the evaporation of the standard hard water rinse, and, in addition, functions as a detergent in dislodging other residue left by the normal cleaning operation. The evaporation of this final rinse water leaves no residue whatever, thereby eliminating the necessity for the hand cleaning operation.

The most convenient means for demineralizing ordinary tap water to make it suitable for the practice of the present invention, consists in passing the water through one or more beds of ion exchange material capable of removing cations and selected anions from the tap water. It is not essential that all of the ions present in the tap water be removed, so long as the dissolved solids and the mineral constituents are substantially removed. In fact, it has been found preferable to leave some of the weak anions in the effluent from the demineralizing step. Specifically, it has been found that the best results are obtained when the demineralized water has a pH in the range from about 4.5 to about 6.0, the acidic character of the water being due to weak ions such as carbonic acid and silicic acid ions being present.

As is well known by those skilled in the art, ion exchange resins fall into four classes. The cation exchange resins are classified as either highly acid or weakly acid resins. The strongly acid ion exchange resins contain groups such as sulfonic acid groups, and typical among these resins are the sulfonated polystyrene resins which are cross linked with divinylbenzene, followed by sulfonation. Other strong acid cation ion exchangers are produced by condensing phenol sulfonic acids with formaldehyde.

The weakly acidic cation exchangers normally contain carboxylic groups and are usually produced by polymerizing vinyl compounds containing carboxylic groups or by carboxylating suitable resins.

The anion exchange resins are similarly classified as highly basic and as weakly basic. A typical highly basic anion exchanger is that type produced by introducing a

quarternary ammonium group into polystyrene or other types of condensation polymers. The weakly basic anion exchange resins are frequently characterized by the presence of secondary amine groups and are manufactured by various condensation reactions involving the use of aliphatic or aromatic amines such as phenylamines.

For the purposes of the present invention, we preferably employ either a strongly acid or weakly acid cation exchanger, in combination with a weakly basic anion exchanger. The two types of exchange resins may be located in separate beds and the tap water passed sequentially through both beds, or the two types of ion exchange materials may be included in a single mixed bed.

As specific examples, the strongly acidic cation exchange resin may be one of the following:

Amberlite IR–120 (sulfonated polystyrene divinyl benzene polymer)
Dowex 50 (phenol sulfonic acid—formaldehyde resin)
Duolite C–3 (phenolic methylene sulphonic resin)
Permutit Q (sulfonated polystyrene divinyl benzene polymer)

The weakly acid cation exchange material may include one of the following resins:

Amberlite IRC–50 (carboxylic type condensation product)
Wofatit C (I. G. Farben Co.) (carboxylic acid type)
Permutit 216 (carboxylic acid type)
Duolite CS–100 (phenolic based carboxylic acid type)
Duolite CS–101 (acrylic resin carboxylic acid type)

The weakly basic anion exchange resin may be selected from one of the following examples:

Amberlite IR–4B (polyamine formaldehyde-diamine condensation polymer)
Amberlite IR–45 (polystyrene amine type)
De-Acidite (aliphatic amine resin)
Duolite A–2 (aliphatic amine resin)
Duolite A–7 (aliphatic amine resin)

For the purpose of this invention, we may also employ a strongly acid cation exchanger in combination with a strongly basic anion exchanger. In this case also, the two types of exchange resins may be located in separate beds and the tap water passed sequentially through both beds, or the two types of ion exchange materials may be included in a single bed.

As specific examples, the strongly basic anion exchange resin may be one of the following:

Amberlite IRA–400 (polystyrene quaternary ammonium amine type)
Amberlite IRA–401 (polystyrene quaternary ammonium amine type)
Amberlite IRA–410 (polystyrene quaternary ammonium amine type)
Amberlite IRA–411 (polystyrene quaternary ammonium amine type)
Duolite A–40 (alkanol aryl quaternary ammonium type)
Duolite A–44 (halogenated polyvinyl aromatic matrix tertiary amine quaternary ammonium type)

The cation exchange resin, is preferably mixed with the anion exchange material in a mixed bed. The advantages of using a mixed bed demineralizer include a reduced capital investment, reduced rinse requirements, increased capacities, and greater versatility in obtaining variations in pH values.

The improved results obtained from the use of the demineralized water of the present invention are not limited to the use of this water in a final rinsing step. Additional improvements are obtained if the detergent composition itself is dissolved in the demineralized water prior to the initial washing and scrubbing. The preferred process, therefore, consists in first wetting down the railway car, as previously done, with cold water, then spraying on a solution of detergent in the demineralized water. Next, the cars are drawn through a set of motor driven wetted brushes where the cars are scrubbed. Subsequently, the detergent is rinsed off with tap water, followed by additional detergent application, rinsing, and scrubbing as required. Finally, after the last tap water rinse, the car is washed down with a spray of the demineralized water. It has been found that about 20 gallons of the demineralized water per car will suffice to eliminate completely any streaks and/or films that may have been formed by the drainage of the tap rinse water, leaving a beautiful sheen to the surface of the car and a bright polish on the windows.

A cost analysis at a typical railroad car washing terminal indicated that the cost of hand wiping windows per car was approximately $2.00. In contrast, the cost of rinsing one car with the demineralized water is about 10 cents or less, a saving of at least $1.90 per car.

In a specific example of the present invention, a number of stainless steel railway passenger cars were scrubbed with a solution of 4 ounces per gallon of an acid detergent including oxalic acid, sodium acid sulfate, and a wetting agent. The solution was left to dry for varying periods of time after which an alkaline detergent was sprayed onto the sides of the car and windows, followed shortly by a tap water flood rinse. After the tap water rinse had substantially drained off, the final mist-spray rinse of demineralized water completed the cleaning operation. The stainless steel panels and the windows of the car were left with a beautiful sheen and completely free of any film or streaks.

The substantially solids-free demineralized water having a pH in the range from about 4.5 to 6 apparently has a solubilizing effect upon the carbonates and bicarbonates present in the tap water, and deposited upon the surfaces during and after rinsing with tap water. At the same time, the solution tends to dislodge other residues or soil left on the windows or on the sides of the car by the normal rinsing procedure.

While the foregoing has dealt primarily with the application of the described procedure to the cleaning of railway cars, it should be evident that it will find use in any type of cleaning operation where the problem of streaking and/or filming is encountered. Specifically, the procedure can be applied to washing diesel engine cars or cabs, trucks, airplanes, and the like.

It will be evident that various modifications can be made to the described embodiments without departing from the scope of the present invention.

I claim as my invention:

1. In the process of washing railway cars and the like in which said cars are washed by spraying with an aqueous solution of a surface active agent, followed by a rinsing with tap water, the improvement which comprises removing streaks which remain after said rinsing by rinsing said cars with a demineralized water.

2. In the process of washing railway cars and the like in which said cars are washed by spraying with an aqueous solution of a surface active agent, followed by a rinsing with tap water, the improvement which comprises removing streaks which remain after said rinsing by rinsing said cars with a demineralized water having a pH in the range from 4.5 to 6.0.

3. A method of rinsing railway cars and the like which comprises demineralizing tap water by contacting said water with an ion exchange resin to eliminate cations and strongly electronegative anions therefrom, and spraying the resulting demineralized water onto said cars.

4. The method of rinsing railway cars and the like comprises demineralizing tap water by contacting said water with an ion exchange resin to eliminate mineral cations and strongly electronegative anions therefrom and to impart thereto a pH in the range from 4.5 to 6.0, and spraying the resulting demineralized water onto said cars to thereby eliminate streaks remaining from a preceding cleaning operation.

5. The method of claim 3 in which said demineralizing

is carried out by passing tap water through a bed of a cation exchange material and also through a bed of weakly basic anion exchange material.

6. The method of claim 3 wherein the demineralizing is carried out by passing tap water sequentially through a bed of cation exchange material and through a bed of weakly basic anion exchange material.

7. The method of claim 3 wherein the demineralizing is carried out in a mixed bed of a strongly acid cation exchange material and a weakly basic anion exchange material.

8. The method of claim 3 wherein the demineralizing is carried out by passing tap water through a bed of weakly acid cation exchange material and also through a bed of weakly basic anion exchange material.

9. The method of claim 3 wherein the demineralizing is carried out by passing tap water through a bed of strongly acid cation exchange material and also through a bed of strongly basic anion exchange material.

10. The method of washing railway cars and the like which comprises dissolving an acidic detergent in a demineralized water, spraying the resulting solution onto said cars, rinsing said cars with tap water, and thereafter removing streaks remaining from the tap water rinsing by washing the cars with a demineralized water.

11. The method of washing railway cars and the like which comprises dissolving an acidic detergent in a demineralized water, spraying the resulting solution onto said cars, rinsing said cars with tap water, and thereafter removing streaks remaining from the tap water rinsing by

washing the cars with a demineralized water having a pH in the range from 4.5 to 6.0.

12. The method of washing railway cars and the like which comprises dissolving an alkaline detergent in a demineralized water, spraying the resulting solution onto said cars, rinsing said cars with tap water, and thereafter removing streaks remaining from the tap water rinsing by washing the cars with a demineralized water.

13. The method of washing railway cars and the like which comprises dissolving an alkaline detergent in a demineralized water, spraying the resulting solution onto said cars, rinsing said cars with tap water, and thereafter removing streaks remaining from the tap water rinsing by washing the cars with a demineralized water having a pH in the range from 4.5 to 6.0.

14. The method of washing railway cars and the like which comprises dissolving an ionic detergent in a demineralized water, spraying the resulting solution onto said cars, rinsing said cars with tap water, and thereafter removing streaks remaining from the tap water rinsing by washing the cars with a demineralized water.

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