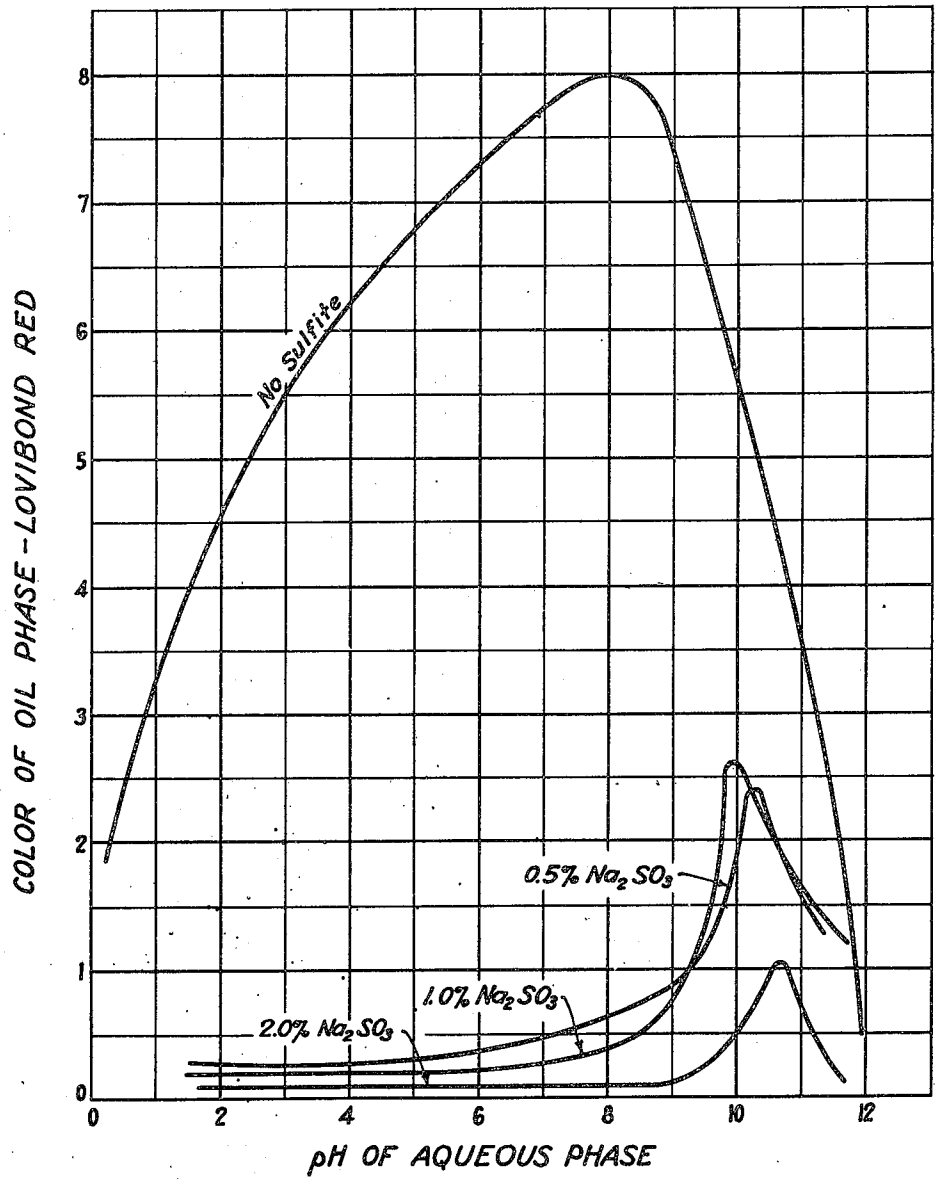
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TRANSPORTING PETROLEUM DISTILLATES

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COLOR-HYDROGEN ION RELATIONSHIP OF KEROSENE AND USED CORROSION INHIBITOR SOLUTION



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TRANSPORTING PETROLEUM DISTILLATES

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1

This invention relates to the prevention of corrosion in pipe lines transporting petroleum products, especially refined petroleum distillates such as gasoline and kerosene. More particularly the invention relates to an anticorrosion agent introduced into ferrous metal pipe lines carrying refined petroleum distillates. One object of the invention is to prevent the discoloration of petroleum distillates in steel pipe lines where an aqueous alkaline solution is employed for the control of corrosion. A more specific object of the invention is to prevent discoloration of petroleum distillates in steel pipe lines in which corrosion is prevented by the use of an aqueous solution of an alkali amide. The invention relates to the "geographical transportation" of oil thru considerable lengths of line, at least twenty-five miles, and usually underground, rather than conveying thru short lines in refineries where no problem of color formation exists.

It has heretofore been found that gasoline and kerosene transported thru steel pipe lines in the presence of alkaline solutions injected for the purpose of controlling pipe line corrosion frequently develop an undesirable color, usually a pink color in the case of water-white kerosene. This color formation has been encountered, for example, when using abnormally low concentrations of the sodium amide inhibitor described in U. S. Patent No. 2,422,515. The cause of the color formation is not clearly understood but it appears to result from an interaction between the corrosion inhibitor and the oil in the presence of iron or iron products. Little color formation is observed at hydrogen ion concentrations of pH=11 or higher and the intensity of the color appears to be maximum at a pH of about 8 to 9. Oxygen is an important factor in the formation of the dye or color complex which is blue in water solution of high alkalinity but pink in oil solution at low alkalinity. In the absence of air, an aqueous solution of the color became brown but the blue color was regenerated when air was added.

According to my invention I prevent the discoloration of the petroleum products by the addition of a small amount of sodium sulfite to the aqueous inhibitor solution introduced into the pipe line. I may also add the sodium sulfite, preferably in aqueous solution, to the gasoline or kerosene as it is introduced into the pipe line. This may be done by injecting a stream, continuously or intermittently, into the oil stream while pumping. When adding it to the pipe line corrosion inhibitor of a sodamide type, I may employ the following formula:

2

	Per cent
Sodium hydroxide	13.26
Ammonia	5.68
Sodium sulfite	2.00
Wetting agent	1.06
Water	78.00

The wetting agent referred to is essentially sodium dioctyl sulfosuccinate.

The amount of sodium sulfite employed for color prevention is usually within the range of about 0.5 to 5 per cent and 1 to 3 per cent appears to be the optimum range. When added as an aqueous solution it may conveniently be dissolved in water to the extent of about 1 to 10 per cent and added to the gasoline in the desired proportions.

A test of the sodium sulfite in a commercial pipe line has been made employing 2% by weight of sodium sulfite in a solution containing 10% of the sodium hydroxide-ammonia inhibitor described in U. S. Patent No. 2,422,515. The rate of addition of the inhibitor plus sodium sulfite was 3 gallons per thousand barrels of petroleum products (42 gallons each) charged to the line. When pumping water-white kerosene, samples of kerosene taken from the line at various points for a distance of 100 miles from the point of introduction of the inhibitor and examined with a Lovibond colorimeter showed no change in color and no development of pink coloration. The effect of sodium sulfite on an off-colored water-white kerosene in the presence of a sodamide inhibitor solution removed from actual pipe line operations is indicated in the graph which accompanies this application. According to the graph the Lovibond red color of the kerosene is shown on the vertical scale plotted against the pH of the aqueous phase in contact with the kerosene. Three concentrations of sodium salts were employed in the aqueous phase and the results show that the discoloration of the kerosene is substantially entirely prevented at a pH of about 8 to 9, at which hydrogen ion concentration a maximum color is produced in the kerosene when no sodium sulfite is present. The low color of the kerosene at high pH values of 11 to 12 is of sub-

stantially no commercial interest because at these concentrations the corrosion of iron is considerably accelerated by the strong alkali.

Although I have described my invention principally as it is applied to inhibitors of the alkali amide type, the invention is also applicable to other alkaline anticorrosion inhibitors for use in pipe lines, such as for example the nitrites employed in combination with strong alkalies such as caustic soda. The most convenient sulfite for use in my invention is sodium sulfite although I may also use potassium sulfite, ammonium sulfite, etc.

As a further example of the effectiveness of the sulfite color inhibitor, the following test was made: Low carbon steel test strips were immersed in mixtures of kerosene and sodamide pipe line inhibitor described in U. S. Patent No. 2,422,515. To one sample 2% of sodium sulfite was added based on the weight of the aqueous inhibitor solution. The metal penetration observed in the case of the sample without the sodium sulfite was .0072 inch per year while the sample containing the sulfite showed a penetration of .0104 inch per year or substantially the same, showing that the sulfite, while preventing color formation, has no adverse effect on corrosion protection. The pH of the solutions in both cases was 8. At the conclusion of the tests, the kerosene layer in the sample without sulfite was observed to be very pink in color while the kerosene sample which contained sodium sulfite was entirely water-white, showing no evidence of pink coloration.

In long pipe lines it may be desirable to inject additional sodium sulfite solution into the oil line transporting the petroleum distillate at intervals, for example intervals of 50 to 100 miles, as there is an indication that the sulfite is used up during the transportation of the oil thru the line. An example of this destruction of sulfite is shown by the following data: Water-white kerosene was transported thru an underground pipe line of 340 miles in length. With the kerosene there was charged to the line at the beginning a corrosion inhibitor comprising essentially 10% solution of sodamide and 3% by weight of sodium sulfite. A sample of the spent inhibitor solution taken from the line at a distance of 213 miles contained only .05% of sodium sulfite, and another sample taken after 340 miles contained not more than a trace of sodium sulfite. Two 1 cc. samples of the spent inhibitor at the 213 mile point, when shaken with 100 cc. of kerosene, imparted to the

kerosene a Lovibond red color of 2 and 3, respectively, whereas two samples taken at the 340 mile point imparted a Lovibond red color of 14.5 and 20, respectively. A sample of water-white kerosene taken from the line after travelling a distance of 103 miles had a Lovibond red color of 0.2 to 0.6 when 3% sodium sulfite was injected with the gasoline at the beginning of the line along with the sodamide inhibitor. When no sodium sulfite was used with the inhibitor, the Lovibond red color was 1.5 to 3.6 after 103 miles, illustrating the effectiveness of the sodium sulfite in preserving the color of the distillate.

Having thus described my invention what I claim is:

1. The method of preventing discoloration of a refined petroleum distillate during geographical transportation thru a ferrous metal pipe line in the presence of a small amount of an aqueous corrosion inhibitor comprised of sodium hydroxide and ammonia in substantially the proportions resulting from the hydrolysis of sodamide having a hydrogen ion concentration corresponding to a pH between 8 and 11, said method comprising introducing into said pipe line simultaneously with said distillate a small amount, not more than 5 per cent based on the weight of the corrosion inhibitor, of a sulfite selected from the class consisting of the sulfites of the alkali metals and ammonium.

2. The method of transporting refined petroleum distillates sensitive to color formation thru a ferrous metal pipe line while protecting said line from corrosion which comprises injecting into said line with said distillate a corrosion inhibitor having substantially the following composition:

	Per cent
Sodium hydroxide	13.26
Ammonia	5.68
Sodium sulfite	2.00
Sodium dioctyl sulfo-succinate	1.06
Water	78.00

LEONARD V. SORG.

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