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Oxidation of Various Types of Lac by Periodic Acid

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Seven different types of lac of Rajshahi region were oxidized with periodic acid. In order to find out the optimum condition of oxidation, a series of experiments was carried out and the effect of time concentration, volume of solvent and the quantity of lac were taken into consideration. Percentage of dihydroxy compound and periodic acid from aleuritic acid, hydrolysed shellac, katiki seed lac, dewaxed shellac, baisaki seed lac, shellac (commercial) and old shellac are (102.50, 368.20), (34.25, 128.79), (15.10, 53.55), (13.95, 50.60), (12.90, 50.29), (12.69, 48.95) respectively.

INTRODUCTION

The lac resin containing free adjacent hydroxyl groups has been advanced by Bhattacharya[1,2]. The consititution of lac, aleuritic acid (9,10, 16-trihydroxy palmitic acid), the chief constituent of lac[3], was confirmed by the work of Raudiatz, *et al.*[4,5] Gidvani and Bhattacarya[6] have studied the oxidation of lac by red lead in glacial acetic acid but the work was confirmed to the possibility of utilizing the oxidized lac for industrial purpose. As the confirmation of the possibility of free adjacent hydroxyl groups being present in lac will considerably help in understanding some of the reactions peculiar to lac resin, it was considered desirable to study the oxidation of lac by periodic acid.

In addition to periodic acid, potassium periodate and lead tetraacetate[7,8] have also been employed. While carrying out some work with these reagents for the oxidation of lac, the experiment shows that periodic acid is to be preferred as an excellent solvent for oxidation of lac also.

The percentage of dihydroxy compound in lac can be obtained from the following equation[9].

$$\% \text{ dihydroxy compound} = \frac{A \times N \text{ thiosulphate} \times \text{m.w. of dihydroxy compound (aleuritic acid)} \times 100}{\text{wt. of sample} \times 2 \times 1000} \quad (1)$$

where A = mL of thiosulphate required for blank – mL of thiosulphate required for the sample.

To facilitate comparison with hydroxyl values, these values are expressed as mg of KOH/g of the substance.

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$$\text{Periodic acid value} = \frac{A \times N \text{ thiosulphate} \times 56.1}{\text{wt. of sample}} \times \text{Normality of thiosulphate} \times 56.1 \quad (2)$$

EXPERIMENTAL

Lac (different types of lac) was collected from the Lac Research Division, BCSIR Laboratories, Rajshahi. All reagents were from E. Merck, Darmastadt, Germany.

Methods: Determination of dihydroxy compound content and periodic acid values of different types of lac:

0.1 g of dry lac (moisture 1%, 40 mesh) was dissolved in 5 mL of glacial acetic acid in which 20 mL of 0.5% periodic acid in 80% acetic acid was added carefully.

The mixture was kept in the dark at room temperature (25–27°C) for 5 min, 10 min, 20 min, 30 min, 60 min, 120 min and 24 h. The mixture was occasionally shaken. The excess iodine was determined iodometrically. Blank experiments were performed simultaneously.

Varying the volume of solvent and amount of shellac the periodic acid values were determined. The percentage of dihydroxy compound and periodic acid values were calculated according to the procedure of Sen Gupta[9] and the results are recorded in Tables 1–4.

TABLE-1
EFFECT OF TIME ON THE PERIODIC ACID VALUES
Wt. Of Shellac = 0.10 g, Amount Of Glacial Acid = 5 mL, Amount Of Reagent = 20 mL

Time in minutes	Periodic acid values
5	40.95
5	41.20
10	43.00
10	44.50
20	43.50
30	45.35
60	47.00
60	47.85
120	46.00
1440	46.75

TABLE-2
EFFECT OF VOLUME OF SOLVENT ON PERIODIC ACID VALUES
Wt. Of Shellac = 0.1 g, Amount Of Solvent = 20 mL, Reaction Time = 60 min

Vol. of glacial acetic acid (mL)	Periodic acid value
5	47.90
5	48.20
10	44.65
10	44.30
20	36.25
20	36.50

TABLE-3
EFFECT OF QUANTITY OF SHELLAC ON PERIODIC ACID VALUE
Amount Of Glacial Acetic Acid = 5 mL, Amount Of Reagent= 20 mL, Reaction Time = 60 min

Wt. of shellac (g)	Periodic acid value
0.10	42.50
0.15	48.25
0.20	46.65
0.25	45.20
0.50	38.60
1.00	33.39

TABLE-4
DIHYDROXY COMPOUND CONTENT AND PERIODIC ACID VALUES OF DIFFERENT TYPES OF LAC

Various types of lac	% dihydroxy compound	Periodic acid value
Katiki seed lac	15.10	53.55
Baisaki seed lac	12.90	50.29
Shellac commercial	12.69	48.95
Hydrolysed shellac	34.25	128.79
Dewaxed shellac	13.95	50.60
Aleuritic acid	102.50	368.20
Old shellac	8.25	28.95

RESULTS AND DISCUSSION

Firstly stress was given to ascertain the duration needed for satisfactory reaction. It was observed that maximum periodic acid values ware obtained after 60 min (Table-1). The values declined before or after 60 min.

From Table-2, it is seen that 5 mL of glacial acetic acid was needed for maximum periodic acid value. On increasing this amount, lesser values were obtained.

From Table-3, it is seen that for the amount of shellac from 0.1 g on wards, lesser periodic acid values were obtained.

Various types of lac were used to estimate the percentage of dihydroxy compound content and periodic acid values and the results were recorded in Table-4.

In the case of aleuritic acid, maximum percentage of dihydroxy compound (102.50) and periodic acid values (368.20) were obtained.

Thus, it may be seen from the above results that the optimum amount of shellac for oxidation is 0.1 g, the optimum time is 60 min and optimum volume of glacial acetic acid used is 5 mL. The best reactive shellac was found to be aleuritic acid.

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