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Synthesis and application of dolomite based eco-friendly powder detergents of renewable starch and glycol origin

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ABSTRACT

A novel ecofriendly polymer synthesized using starch, glycerol, sorbitol and maleic anhydride was found to be biodegradable having BOD to COD Ratio 0.6075(1). After ensuring its biodegradability and HLB Ratio we have decided to use it for the detergent formulation. Few formulations based on dolomite, polymer combination were formulated. These polymer dolomite detergent combination have shown good performance characteristics as for as reduction in surface tension of water, foam volume and percent detergency is concerned.

INTRODUCTION

The dolomite and polymer based ecofriendly powder detergents were formulated using varying proportions of polymer ,dolomite,acid slurry,STPP,SLS,SLES. Dolomite proportion was varied from 8.33 to 26.66%.

The formulations O11 to O14 have shown excellent performance as far as reduction in surface tension of water ,foam volume and percent detergency is concerned.

MATERIALS AND METHODS

1.1 EXPERIMENTATION

The method of polymer synthesis published in journal [2].

1.2 METHOD OF PREPARATION OF POWDER DETERGENT BY MIXER USING POLYMER WITH OTHER ADDITIVES

In this method the Polymer , Acid Slurry , EDTA , STPP , Sodium Carbonate , S.L.S. , S.L.E.S. , C.M.C, dolomite, and water taken in a mixer pot .

All the contents were mixed together for 15 to 20 minutes in a mixer pot. After ensuring the intimate contact of all the contents in a mixer the detergent were taken out.

Looking to the moisture percentage, the detergents were taken in a tray for sun dry. The detergents were sun dried for 48 hrs.the detergents were monitor daily to check the moisture level. After getting dry – free flowing detergent then same were packed into air Tight Polythene Pocket.

This Method Suits Well To Laboratory Conditions Without Much Financial Impact.

Determination of reduction in surface tension of water, foam volume, percent detergency of soil stained, tea stained, coffee stained cotton cloth is published [3].

Table 1 Synthesis of Polymer Based On Starch, Sorbitol, Glycerol, Maleic Anhydride

Raw Material	Batch 13 (%)
Starch	30.76
Sorbitol	nil
Glycerol	53.84
Maleic Anhydride	15.38

Table 2 Formulation of Powder Detergent Based On Dolomite-Polymer 13 (Composition % by Weight)

RAW MATERIALS	O ₁₁	O ₁₂	O ₁₃	O ₁₄
Polymer (100%)	8.33	7.69	7.14	6.66
Acid Slurry (100%)	8.33	7.69	7.14	6.66
Sodium Carbonate	50.00	46.15	35.71	33.33
Ethylene Diamine Tetraacetic Acid.	4.16	3.84	3.57	3.33
Sodium tripolyphosphate	4.16	3.84	3.57	3.33
Sodium Lauryl Sulphate	1.66	1.53	1.42	1.33
Sodium Lauryl Ether Sulphate.	1.66	1.53	1.42	1.33
Carboxy Methyl Cellulose.	0.41	0.38	0.35	0.33
DOLOMITE	8.33	15.38	21.42	26.66
WATER	12.96	11.97	18.26	17.04

Note: Polymer Was Used As A Solution In Water (74%Solid)

Acid Slurry Was Used As A Solution In Water (84%Solid)

Table 3 Physicochemical Properties of powder Detergents (Dolomite mixed with Polymer 13)

Sr. No.	SAMPLE	pH VALUE	MOISTURE CONTENT
1	O ₁₁	9	8
2	O ₁₂	11	8
3	O ₁₃	12	8
4	O ₁₄	12	8

Table 4 Study of Surface Tension of Water at Various Concentration of Detergent

SAMPLE	CONCENTRATION	S.T. IN DYNE/CM	%REDUCTION IN S.T. OF WATER
O ₁₁	0.1	34.13	52.05
	0.25	27.42	61.47
O ₁₂	0.1	30.33	57.38
	0.25	24.91	65.00
O ₁₃	0.1	47.21	33.67
	0.25	40.37	43.27
O ₁₄	0.1	55.49	22.04
	0.25	45.55	36.00
Surf excel	0.1	46.42	35.61
	0.25	42.66	40.83

Table 4 Study of Foam Volume At 0.1% Concentration of Detergent

SR.NO.	SAMPLE	FOAM VOLUME IN CM ³				
		TIME IN MIN				
		0	5	10	15	20
1	O ₁₁	410	410	410	410	410
2	O ₁₂	200	200	200	200	200
3	O ₁₃	150	150	150	150	150
4	O ₁₄	120	120	120	120	120
5	Surf excel	80	80	70	70	70

Table 5 Study of Foam Volume At 0.25% Concentration of Detergent

SR.NO.	SAMPLE	FOAM VOLUME IN CM ³				
		TIME IN MIN				
		0	5	10	15	20
1	O ₁₁	420	420	420	420	420
2	O ₁₂	250	250	250	250	250
3	O ₁₃	220	220	220	220	220
4	O ₁₄	110	110	110	110	110
5	Surf excel	150	150	140	140	140

Table 6 Study of Percent Detergency at Different Concentration on Soil Stained Cotton Cloth

Ro=Reflectance Measured On Clean Cotton Cloth=80.1

Rs=Reflectance Measured On Soiled Cotton Cloth=22

Rw=Reflectance Measured On Washed Cotton Cloth.

SR.NO.	SAMPLE	CONCENTRATION	% DETERGENCY
1	O ₁₁	01	80.59
		0.25	81.47
2	O ₁₂	0.1	81.27
		0.25	82.86
3	O ₁₃	0.1	82.52
		0.25	84.15
4	O ₁₄	0.1	83.91
		0.25	84.84
7	Surf excel	0.1	54.18
		0.25	72.75

Table7 Study of Percent Detergency at Different Concentration on Tea Stained Cotton Cloth

Ro=Reflectance Measured On Clean Cotton Cloth=80.1

Rs=Reflectance Measured On Tea cotton Cloth=33

Rw=Reflectance Measured On Washed Cotton Cloth

SR.NO.	SAMPLE	CONCENTRATION	% DETERGENCY
1	O ₁₁	01	83.83
		0.25	85.11
2	O ₁₂	0.25	84.26
		0.1	86.29
3	O ₁₃	0.1	84.87
		0.25	87.10
4	O ₁₄	0.1	85.85
		0.25	89.56
5	Surf excel	0.1	69.23
		0.25	74.43

Table 8 Study of Percent Detergency at Different Concentration on Coffee Stained Cotton Cloth

Ro=Reflectance Measured On Clean Cotton Cloth=80.1

Rs=Reflectance Measured On Coffee Cotton Cloth=29

Rw=Reflectance Measured On Washed Cotton

SR.NO.	SAMPLE	CONCENTRATION	% DETERGENCY
1	O ₁₁	01	82.32
		0.25	83.83
2	O ₁₂	0.1	82.83
		0.25	84.76
3	O ₁₃	0.1	83.61
		0.25	85.68
4	O ₁₄	0.1	84.31
		0.25	86.17
7	Surf excel	0.1	76.49
		0.25	80.26

RESULTS AND DISCUSSION

The polymer was synthesized using 30.76 % starch, 53.84% glycerol, 15.38% maleic anhydride.

The polymer was found to be bio-degradable in nature as BOD to COD ratio was found 0.6075. refer table no.1.

As evident from table 2 various powder detergent samples were formulated using active ingredients of detergents, polymer and dolomite.

The percentage of STPP was varied between 3.33 % to 4.16%. and SLS percentage was varied between 1.33% to 1.66%.

The pH value of all these polymers O11 to O14 was determined. As evident from table 3 all the samples have shown pH value in the alkaline range in which cleaning action is effective.

And moisture content is also found to be in the reasonable limit.

The study of surface tension of water at various concentration of detergents was performed.

As evident from the table no.4 all the samples of powder detergents have shown reduction in surface tension water better than conventional sample surf excel.

The study of foam volume of detergents at various concentration was studied.

As evident from table no.4 at 0.1% concentration of detergent an appreciable amt.of foam formation is also seen.

The foam forming ability of detergent helps in the redeposition of soil and dirt. and has cosmetic importance also.

All the dolomite and polymer based formulations have shown excellent performance even at very small percentage of detergents.

The most important study as far as detergent performance is concerned is percent detergency.

All the formulation have shown good performance as far as its cleaning ability is concerned.

The samples O11 to O14 have shown excellent cleaning ability, even at 0.1% concentration of detergent percent detergency on soil stained cotton cloth was remarkable and samples O11 to O14 have shown 80.59 % to 83.59% percent detergency at 0.1 % concentration of detergent.

The percent detergency of detergents on tea stained cotton cloth was also studied.

The samples O11 to O14 have shown excellent tea stain cleaning at lowest concentration of detergents i.e. at 0.1% to 0.25% as evident from table 7.

The sample O14 containing 26.66% of dolomite has shown 85.85 % detergency on tea stained cotton cloth at 0.1% concentration of detergent.

The percent detergency of detergents on coffee stained cotton cloth have shown similar encouraging results to that of soil stained and tea stained cotton cloth.

The samples O11 to O14 have shown percent detergency of 82.32% to 84.31% at lowest concentration of detergent i.e. at 0.1 % as evident from table 8. The sample O14 containing 26.66% dolomite has shown highest cleaning action at 0.1 % to 0.25% detergent concentration.

CONCLUSION

The study of dolomite based detergents reveals the positive impact of dolomite addition to the polymer has helped in improving the performance characteristics of surfactants to a great extent.

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