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Comparative Study on the Effect of Jute Seed Oil Emulsions with that of Conventional Emulsions Using Mineral Oil on Yarn Quality in Jute Processing

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Abstract: An emulsion making process has been developed for spinning hessian type jute yarn by eliminating mineral oil from the normal sequence of emulsion processing. A number of experiments were carried out with jute fibers and 242 and 280 tex yarn were spun on the hessian spinning frame. It was observed that the elimination of mineral oil in emulsion processing did not make the yarn quality worse.

Keywords: Emulsion, spinning, yarn, tex, drawing frame

Introduction

From the very inception of mechanical processing of jute, batching oil was proved to be an essential ingredient for processing jute into regular yarn. The conventional jute batching oil is a mineral oil. From last couple of years, some jute goods importing countries have raised objections regarding the use of mineral oil. As a result it has become inevitable to find out substitute oil for using in jute softening, preferably from vegetable or other sources. Therefore, this work was aimed at identifying and finding a suitable substitute of mineral oil from jute seed oil which could be used effectively for jute processing and at the same time found acceptable to the importers (Kaul and Das, 1986).

The ideas is that if the splitting and breaking of fibers and their regular placement are done in an efficient way at the spinning stage, the omission of mineral oil may not have any adverse effect on the yarn quality (Amin, 2001). Moreover, economic cost could be achieved in terms of capital. This work was undertaken by considering this point of view.

Materials and Methods

This work has been completed by two years. Four batches each of 70 lbs of jute fibres Bangla White-B (BWB) were taken for experiment. Two batches of those were softened in the softener machine with an application of 25% mineral oil emulsion (mineral oil-20%, nonidet-0.3% and water-79.7%) by the weight of fibre. The rest of two batches were softened in the softener machine with an application of 25% jute seed oil emulsion (jute seed oil-10%, nonidet-0.35% and water-89.65%) by the weight of fibre. Then the softened jute sample were kept in piling condition for 48 h and were processed through normal jute processing sequence i.e. breaker card machine, finisher card machine, 1st, 2nd, 3rd draw frame and yarn of 242 (7lbs/spy) and 280 tex (8lbs/spy) nominal count were spun in hessian type spinning frame, respectively. Different emulsion, actual count, twist, tenacity, quality ratio were checked after experiment.

Results and Discussion

Jute seed oil was extracted for the preparation of jute batching emulsion in this investigation. Prior to preparation of emulsion, oil characteristics, emulsion ingredients such as oil, nonidet, water were noted (Table 1). The oil was found to be stable at ambulant temperature

Table 1: Ingredients % of different emulsions

Experiments	Emulsion ingredients (%)		Remarks
Emulsion with mineral oil	Mineral oil	20.0	Little oil droplet was found on storage for 7 days
	Nonidet	0.3	
	Water	79.7	
Emulsion with jute seed oil	Jute seed oil	10.0	No oil droplet was found on storage for 7 days
	Nonidet	1.1	
	Water	88.9	

Table 2: Dust content % of breaker card and finisher card

Sample description	Dust content (%)	
	Breaker card	Finisher card
Jute fibers treated with:		
Batch-1: Jute seed oil	1.61	0.61
Batch-2: Mineral oil	1.57	0.57
Batch-3: Jute seed oil	1.60	0.60
Batch-4: Mineral oil	1.62	0.58

Table 3: Oil concentration (%) in different emulsions used on the processing of jute fibres

Sample	Oil used in emulsion	% of oil in emulsion	Emulsion used by weight of jute (%)
Batch –1	Jute seed oil	10	25
Batch –2	Conventional mineral oil	20	25
Batch –3	Jute seed oil	10	25
Batch –4	Conventional mineral oil	20	25

Table 4: Physico-mechanical properties and spinning performance of yarns

Batch	Statistics	Actual count tex (lbs./spy)	Twist (tpm)	Max. load (N)	Extn. %	Tenacity N/tex	Text. mod N/tex	Toughness mN/tex	Quality ratio %
Batch-1	Mean	242.2	182.00	30.01	1.31	0.124	9.54	0.863	95.92
	SD	(7.03)	27.80	5.77	0.20	0.024	0.56	0.295	18.46
	CV%		15.27	19.24	15.5	19.24	5.85	34.13	19.24
Batch-2	Mean	250	183.00	29.76	1.54	0.119	7.84	0.992	92.20
	SD	(7.25)	23.59	5.03	0.23	0.020	0.62	0.284	15.60
	CV%		12.59	16.90	14.7	16.897	7.86	28.68	16.90
Batch-3	Mean	281.8	181.00	34.74	1.79	0.123	6.90	1.232	95.40
	SD	(8.18)	29.98	5.53	0.24	0.020	0.42	0.365	15.20
	CV%		16.56	15.93	13.5	15.93	6.04	29.66	15.90
Batch-4	Mean	280.1	180.00	35.0	1.8	0.14	6.01	1.21	96.01
	SD	(8.01)	28.00	5.1	0.25	0.018	0.39	0.293	14.92
	CV%		15.5	14.1	14.0	14.90	5.95	29.01	14.01

and it did not solidify at room temperature. The oil was therefore, considered to be suitable for preparation of jute batching emulsion with water. In normal sequence of emulsion processing of jute, the fibre is first softened by passing it through fluted rollers with an application of emulsion (oil, water and emulsifier). In this stage of emulsion making process instead of mineral oil, jute seed oil was used (Islam, 1993).

In view of the mechanical consideration, jute fibers were spun to yarns of 242 (7lbs/spy) and 280 tex(8lbs/spy) by the application of emulsion with mineral oil and jute seed oil respectively. The spinning operation was smooth. Minor weight loss of jute fibre through processing in the breaker card and finisher card machine were encountered during the spinning operations (Table 2). The fibre losses of jute seed emulsion were comparable to those occurring in the spinning operations with mineral oil emulsion. This comparison is almost same (Kundu, 1958; Ranjan, 1985). Referring to Table 4, the quality of yarns of Batch 1 and Batch 3 are found almost the same as that of batch, 2 and 4 which is processed by conventional emulsion. It may be noted that use of less percentage of jute seed oil than mineral oil (Table 3) in both the cases, resulted in almost similar yarns. Moreover, it is encouraging to note that yarns of almost same quality ratio and CV (coefficient of variation) were produced by the use of only 10% jute seed oil in the emulsion in place of 20% mineral oil in the emulsion. In addition jute seed oil emulsion has the following comparable advantages (Atkinson, 1964, 1965). Physical properties of produced yarns were tested by a computerized Instron Machine of Testing and Standardization Department of Bangladesh Jute Research Institute under standard atmospheric condition, 65%, RH and 20°C temperature.

No difficulty is encountered in spinning the jute fibres in the jute spinning frame by using the jute seed oil emulsion.

Droppings percent in the breaker card and finisher cards for jute seed oil emulsion and mineral oil emulsion are almost same (Kaul and Das, 1986; Salam, 1995).

The QR, CV and yarn tenacity of the experimental yarns is also almost same to those of jute yarns manufactured with mineral oil emulsion.

This comparison appears to provide a new outlet for the utilization of fresh jute seeds for the production of jute seed oil to be used as a substitute of conventional mineral oil for spinning of the jute fibre. It is finally found that the elimination of mineral oil in emulsion processing did not make the yarn quality worse.

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