

Starched fabric as protective cover for pesticide applications

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■ **ABSTRACT** : The garments worn by the pesticide applicators may not provide adequate protection to the skin, when contaminated with a sprayed liquid, unless the surface of the fabric has been treated in some way to reduce the penetration to an acceptable level. So, a study was conducted in which the cotton/ polyester blended samples were given barrier treatment with 10 per cent, 20 per cent and 30 per cent starch solution and pesticide was sprayed on all these samples. These pesticide contaminated cotton/ polyester blended samples were given different laundering treatments *i.e.* 5 per cent salt at 50°C, 5 per cent salt at 80°C, 2 per cent heavy duty detergent at 50°C, 2 per cent heavy duty detergent at 80°C. While comparing the transmittance, it was observed that the starched samples given barrier treatment with 20 per cent starch solution had more per cent transmittance value than the samples treated with 10 per cent and 30 per cent starch solution thus reducing penetration of pesticide to some level. Further, it was observed that washing cotton/ polyester blended fabric with 2 per cent heavy duty detergent solution at 80°C was the best condition from all the starched samples. Overall, cotton/ polyester blended fabric given barrier treatment with 20 per cent starch solution and laundered with 2 per cent heavy duty detergent solution at 80°C can be recommended for the pesticide applicators as it reduced the contamination.

■ **KEY WORDS** : Cotton / polyester blended, Fenvalerate, Spectrophotometer, Starch, Transmittance

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Human pesticide poisoning has become major public health issue these days. Throughout the world highest levels of pesticide exposure are found in the farm workers, applicators and people living adjacent to heavily treated agricultural land. Pesticides are linked to various chronic diseases like cancers, infertility, kidney failure, reproductive problems and nervous disorders. Early symptoms of acute poisoning include weakness, nausea, vomiting, excessive sweating, salivation, headache, skin rashes, ocular problems and difficulty in walking (Mehler *et al.*, 1992). Later symptoms of severe poisoning may include unconsciousness, pulmonary edema, respiratory failure and death. Even a single episode of organophosphate intoxication has been associated with a persistent decline in neuropsychological functioning (Rosenstock *et al.*, 1991). However, firm conclusions on neuropsychological effects of chronic exposure to pesticides are difficult to draw since information is scarce, particularly in developing countries (London *et al.*, 1998). Both acute and

chronic effects are of great concern. However, chronic effects, including neurological and reproductive effects and cancer are more difficult to ascertain, although some studies have found associations between pesticide exposure and these chronic effects (Blair *et al.*, 1993).

To combat with such situations, the present study had been carried out to safeguard the pesticide applicators from the harmful effects of pesticides by giving barrier treatment to the fabrics to reduce the penetration of pesticides into the fabric.

Objectives:

- To study the barrier performance of starch as protective finish on cotton/ polyester blended fabric through the pesticide residue analysis.
- To compare the amount of barrier treatment for the protection of pesticide applicators.

RESEARCH METHODS

Selection of materials:

In year 2011, pure white cotton/ polyester blended fabric with plain weave was procured and its physical properties were examined. The experiment was conducted in Department of Clothing and Textiles, PAU, Ludhiana. Fenvalerate 20 EC pesticide was used for the experiment. A barrier treatment was provided to the cotton/ polyester blended fabric with locally available eco-friendly starch. After spraying the pesticide on fabric given barrier treatment with 10 per cent, 20 per cent and 30 per cent starch solution, the pesticide was stripped with the laboratory grade chemicals, acetone and hexane.

Procedure of work:

Fifteen test fabric samples measuring 15x15 cm were cut from the scoured fabric. Five of the samples were given barrier treatment with the application of 10 per cent, 20 per cent and 30 per cent starch solution each and allowed to dry. Pesticide spray solution was prepared and applied on all the starched samples. The undisturbed samples were allowed to dry overnight.

All the starched samples were laundered as per the following laundering conditions:

- Control – unwashed samples
- 5 per cent salt water at 50°C for one hour
- 5 per cent salt water at 80°C for one hour
- 2 per cent detergent at 50°C for one hour
- 2 per cent detergent at 80°C for one hour

These samples were separately steeped in salt and heavy duty detergent and separately washed in 50°C and 80°C temperatures. Later, each sample specimen was rinsed separately in a beaker to avoid cross contamination and dried in sunlight.

A solution of hexane: acetone was prepared. Each sample was separately dipped in separate beaker and the solution was allowed to evaporate till only 5 ml of hexane: acetone was left. The experiment was repeated three times for each condition.

The per cent transmittance was observed for all the samples *i.e.*, their control samples and the samples when washed under different laundering conditions using UV/VIS spectrophotometer (UV 3000+).

RESEARCH FINDINGS AND DISCUSSION

The pesticide residue of the cotton/ polyester blended samples, given barrier treatment with 10 per cent, 20 per cent and 30 per cent starch solution was compared. The interaction among the five treatments given to these samples starched with 10 per cent and 20 per cent was studied (Table 1). The difference among the values showed that there was an interaction among the samples given barrier treatment with 10 per cent and 20 per cent starch solution. The value of transmittance was more in case of samples starched with 20 per cent as compared to samples starched with 10 per cent with all the laundering treatments. By comparing these samples, it was found that the maximum value of per cent transmittance (65.40 %) was observed in the case of 20 per cent starched samples when treated with 2 per cent heavy detergent at 80°C. By applying the analysis of variance on the experimental data of the starched samples, it was concluded that the difference among all the values of transmittance (%) of pesticide residue was significant ($p \leq .05$).

The interaction among the five treatments given to the samples starched with 20 per cent and 30 per cent was also observed (Table 2). The difference among the values showed that there was an interaction among the samples starched with 20 per cent and 30 per cent. The value of transmittance was more in case of samples starched with 20 per cent as compared to samples starched with 30 per cent with all the laundering treatments. By comparing these samples it was found that the maximum value of per cent transmittance (65.40%) was observed in the case of samples given barrier treatment with 20 per cent starch solution when treated with 2 per cent heavy detergent at 80°C. By applying the analysis of variance on the experimental data of the starched samples, it was concluded that the difference among all the values of transmittance (%) of pesticide residue was significant ($p = .05$).

Further the interaction among the five treatments given to the samples, starched with 10 per cent and 30 per cent solution was studied (Table 3). The difference among the values showed that there was an interaction among the samples starched with 10 per cent and 30 per cent. The value of transmittance was more in case of samples starched with 10 per cent as compared to samples starched with 30 per cent with all the laundering treatments. By comparing these samples, it was found that the maximum value of per cent

Table 1 : Comparison of pesticide residue between starched 10% and 20% starched cotton/ polyester blended samples			
Treatments	Starched (10%)	Starched (20%)	Mean
Control	9.07	21.40	15.23
5% salt at 50°C	12.73	25.80	19.27
5% salt at 80°C	46.27	45.40	45.83
2% detergent at 50°C	62.33	59.80	61.07
2% detergent at 80°C	64.20	65.40	64.80
Mean	38.92	43.56	

Table 2 : Comparison of pesticide residue between starched 20% and 30% starched cotton/ polyester blended samples

Treatments	Starched 20%	Starched 30%	Mean
Control	21.40	24.80	23.10
5% salt at 50°C	25.80	29.80	27.80
5% salt at 80°C	45.40	48.60	47.00
2% detergent at 50°C	59.80	52.60	56.20
2% detergent at 80°C	65.40	55.80	60.60
Mean	43.56	42.32	

Table 3 : Comparison of pesticide residue between starched 10% and 30% starched samples

Treatments	Starched 10%	Starched 30%	Mean
Control	9.07	24.80	16.93
5% salt at 50°C	12.73	29.80	21.27
5% salt at 80°C	46.27	48.60	47.43
2% detergent at 50°C	62.33	52.60	57.47
2% detergent at 80°C	64.20	55.80	60.00
Mean	38.92	42.32	

transmittance (64.20%) was observed in the case of 10 per cent starched samples when treated with 2 per cent heavy detergent at 80°C. By applying the analysis of variance on the experimental data of the starched samples, it was concluded that the difference among all the values of transmittance (%) of pesticide residue was significant ($p \leq .05$).

Conclusion:

The value of per cent transmittance for the cotton/ polyester blended samples increased as follows: samples treated with 30 per cent starch solution < samples treated with 10 per cent starch solution < samples treated with 20 per cent starch solution. The overall data showed that the samples treated with 20 per cent starch solution had the maximum transmittance value as compared to the samples treated with 10 per cent and 30 per cent starch solution. Thus, cotton/ polyester blended fabric given barrier treatment with 20 per cent starch solution and laundered with 2 per cent heavy duty detergent solution at 80°C can be recommended for the pesticide applicators.

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