EXECUTIVE SUMMARY

M/s Indian Centre for Plastics in the Environment, Mumbai sponsored the project. The sponsor supplied the plastic woven sacks as well as jute sacks required for the studies.

Wheat, Paddy, Rice and Sugar were stored in Jute sacks, High-density polyethylene (HDPE) and Polypropylene (PP) woven sacks for six months to study the effect of sacks on the quality of packaged food.

The following are important findings of the study.

I. WHEAT

- No significant difference was observed in any of the physico-chemical characteristics of wheat on six months storage in the three different packaging materials.

II. PADDY AND RICE

- Samples could not be stored for more than eight days under accelerated conditions (38^0C, 90% RH).
- The moisture of the grains during six months of storage under ambient condition remained same (11-12%) in all three types of sacks.
- Hydration behaviour at room temperature was same in rice packed in all three types of sacks.
- Swelling and solubility of rice flour made from packaged and stored rice remained almost same for all types of sacks.

III. SUGAR

- Sugar was stored only under ambient condition in all three packaging materials.
- No significant differences were observed between the Jute, HDPE and PP sacks with respect to moisture content, colour and odour.
- The overall quality of the sugar packed in plastic woven sacks was not adversely affected during storage.

IV. DNA FINGERPRINTING

- The integrity of the genetic material of wheat, rice and paddy was evaluated by studying the integrity of a marker (a small piece of DNA associated with a certain trait) such as the housekeeping gene before and after storage.
- Positive amplification was observed for the 18S rDNA of rice, wheat and paddy stored in Jute, HDPE and PP for six months.
- The possibility of any free radicals or monomers from the plastic materials did not show any direct effect in the *invitro* studies.
- Amplification experiments of the 18S rDNA, glutenin / sucrose phosphate synthase genes did not show any detectable changes within the period of the study.
- These marker genes were detected in the grains stored for six months in Jute, HDPE and PP sacks.

V. INFESTATION ASPECTS

- PP and HDPE woven sacks were superior in the prevention of insect penetration compared to Jute sacks.

- Fungal spoilage was very fast and visible fungal growth observed when paddy and rice were stored at accelerated conditions.
- No significant increase in the fungal population in all the three packaging materials for the rice grains when stored under room temperature.
- Fungal populations decreased significantly in case of wheat stored under room temperature.

VI. GLOBAL MIGRATION

- Global migration values for HDPE and PP woven sacks tested with different food simulants were well below the specified maximum limits as per BIS specifications.
- WVTR of unlined HDPE and PP woven sacks were high as compared to Jute sacks.
- Breatheability of HDPE and PP woven sacks were comparable to that of Jute sacks.
- Higher value of coefficient of friction in PP woven sacks will help in stacking the sacks.

VII. ODOUR PICK UP BY THE STORED FOOD GRAINS

- Electronic nose could be used for detection of changes in odor occurring during storage of packaged foods.
- Odour of packaged food changes on storage, but these changes are not caused by the packaging material.
- Paddy, Rice and Sugar did not pick up any significant odour from the packaging films up to six months of storage under ambient conditions.
- Wheat was found to have slight odour pick up from the packaging material at the end of six months of storage.

VIII. OVERALL CONCLUSIONS

- The study conducted under this project has shown that HDPE and PP woven sacks can be used for bulk packaging of paddy, rice, wheat and sugar.

Paddy, rice, wheat and sugar packaged in HDPE and PP woven sacks and stored at ambient condition for six months did not undergo any significant changes in physico-chemical characteristics.