

# ANALYSIS OF RESULTS/CONCLUSIONS/ RECOMMENDATIONS

## 1) DEHYDRATED ONION FLAKES

Annexure-IIA, IIB, IIC, IID, IIE & IIF and IIIA, IIIB, IIIC, IIID, IIIE & IIF give the results of the tests conducted on the products withdrawn at regular intervals during the storage trials at accelerated conditions and standard conditions respectively.

The shelf-life of the product packed in ordinarily packed pouches and gas flushed pouches from the selected six packaging materials at both storage conditions is given in Annexure-VIII. While analyzing the results, the main critical factors considered for determination of shelf-life are moisture content level (CMC : 8-00%) and rancidity. From the results, it is observed that the product does not become rancid in all six selected packaging materials even at the end of storage studies at both sets of conditions.

From the results of both the sets of conditions, it is observed that when the product crosses the critical moisture level, a change in texture is observed and the product become unsaleable.

It is observed that there has been no change in odour of the product in pouches (ordinarily and gas flushed) made from all the six packaging materials even at the end of storage studies at both the sets of conditions. Packaging materials also do not show any changes with respect to softening, cracking or delamination. All the heat seals were found to be intact and the hydrogen gas was retained in all pouches even at the end of storage period at both sets of conditions.

From the results, it can be seen that the maximum shelf-life of the product is achieved in material No.1 i.e. 12 micron PET/ 9 micron Al. foil / 37.5 micron LDPE which is 113 days and 128 days at accelerated conditions respectively for ordinary pouches and gas flushed pouches and 216 days and 238 days at standard conditions respectively for ordinary pouches and gas flushed pouches.

Material No.6 i.e. 125 micron HDPE gives a shelf-life of 101 days and 114 days at accelerated condition in ordinary and gas flushed pouches respectively. The shelf-life achieved in this materials at standard condition in ordinary pouches and gas flushed pouches is 198 days and 218 days respectively.

Material No.2 i.e. 12 micron MET.PET/37.5 micron LDPE gives a shelf-life of 88 days and 99 days at accelerated conditions in ordinary pouches and gas flushed pouches respectively. At standard conditions, this material gives a shelf-life of 182 days and 206 days in ordinary pouches and gas flushed pouches respectively. Material No.4 i.e. 20 micron BOPP/12 micron PET/37.5 micron LDPE gives a shelf-life of 68 days and 80 days at accelerated conditions in ordinary pouches and gas flushed pouches respectively. At standard conditions, this material gives a shelf-life of 160 days and 178 days in ordinary pouches and gas flushed pouches respectively. However, material No.3 i.e. 12 micron PET/30 micron LDPE-HDPE gives a reduced shelf-life of 40 days and 48 days at accelerated conditions and 80 days and 96 days at standard conditions.

Annexure-XI indicates the order of priority/merit of the six packaging materials selected for the study based on their performance for shelf-life.

Based on the results obtained from shelf-life studies, the materials recommended to be used for the primary packaging of the product are :

- a) 12 micron PET/9 micron Al.Foil/37.5 micron LDPE
- b) 125 micron HDPE

The specifications of the recommended packaging materials are given at Annexure-XXIII.

## **2) DEHYDRATED GARLIC POWDER**

Annexures – IVA, IVB, IVC,IVD, IVE & IVF and VA, VB, VC,VD, VE & VF give the results of the tests conducted on the products withdrawn at regular intervals during the storage trials at accelerated conditions and standard conditions respectively.

The shelf-life of the product packed in ordinary packed pouches and gas flushed pouches from the selected six packaging materials at both storage conditions is given in Annexure-IX. While analyzing the results, the main critical factors considered for determination of shelf-life are moisture content level (CMC : 5-00%) and rancidity. From the results, it is observed that the product does not become rancid in all six selected packaging materials even at the end of storage studies at both sets of conditions.

From the results of both the sets of conditions, it is observed that when the product crosses the critical moisture level, a change in texture is observed and the product become unsaleable.

It is observed that there has been no change in odour of the product in pouches (ordinary & gas flushed) made from all the six packaging materials even at the end of storage studies at both the sets of conditions. Packaging materials also do not show any changes with respect to softening, cracking or delamination. All the heat seals were found to be intact and the nitrogen gas retained in all the pouches even at the end of storage period at both the sets of conditions.

From the results, it can be seen that the maximum shelf-life of the product is achieved in material No.1 i.e. 12 micron/9 micron Al. foil/37.5 micron LDPE which is >120 days and >120 days at accelerated conditions respectively for ordinary pouches and gas flushed pouches and >365 days and >365 days at standard conditions respectively for ordinary pouches and gas flushed pouches.

Material No.6 i.e. 250 micron HDPE gives a shelf-life of 115 days and >120 days at accelerated conditions in ordinary pouches and gas flushed pouches respectively. The shelf-life achieved in this material at standard conditions in ordinarily packed pouches and gas flushed pouches is 348 days and 358 days respectively. Material No.2 i.e. 12 micron MET.PET/37.5 micron LDPE gives a shelf-life of 105 days & 118 days at accelerated conditions in ordinary and gas flushed pouches respectively. At standard conditions, this material gives a shelf-life of 325 days and 344 days in ordinary pouches and gas flushed pouches respectively. Material No.4 i.e. 20 micron BOPP/12 micron PET/37.5 micron LDPE gives a shelf-life of 62 days and 75 days at accelerated conditions in ordinary and gas flushed

pouches respectively. At standard conditions, this materials gives shelf-life of 170 days and 184 days in ordinary pouches and gas flushed pouches respectively.

However, material No.3 & 5 give reduced shelf-life ranging from 30 days to 45 days in ordinary pouches at accelerated conditions and 42 days to 58 days in gas flushed pouches at accelerated conditions. At standard conditions, the shelf-life ranging from 84 days to 122 days in ordinary packed pouches and 96 days and 140 days in gas flushed pouches.

Annexure-XII indicates the order of priority/merit of the six packaging materials selected for study based on their performance for shelf-life.

Based on the results obtained from shelf-life studies, the materials recommended to be used for the primary packaging of the product are :

- a) 12 micron PET/9 micron Al. Foil/37.5 micron LDPE
- b) 250 micron HDPE

The specifications of the recommended packaging materials are given at Annexure-XXIV.

### **3) ACCELERATED FREEZE-DRIED CORN :**

Annexures - VIA, VIB, VIC,VID, & VIE and VIIA, VIIB, VIIC,VIID and VIIE give the results of the tests conducted on the products withdrawn at regular intervals during the storage trials at accelerated conditions and standard conditions respectively.

The shelf-life of the product packed in ordinarily packed pouches and gas flushed pouches from the selected five packaging materials at both storage conditions is given in Annexure-X. While analysing the results, the main critical factors considered for determination of shelf-life are moisture content level (MC : 6.00%) and rancidity. From the results, it is observed that the product does not become rancid in all the five selected packaging materials even at the end of storage studies at both sets of conditions.

From the results of both sets of conditions, it is observed that when the product crosses the critical moisture level, a change in texture is observed and the product becomes unsaleable.

It is observed that there has been no change in odour of the product in pouches (ordinary and gas flushed) made from all five packaging materials even at the end of storage studies at both sets of conditions. Packaging material also does not show any changes with respect to softening, cracking or delamination. All the heat seals were found to be intact and the nitrogen gas was retained in all pouches even at the end of storage period at both sets of conditions.

From the results, it can be seen that maximum shelf-life of the product is achieved in material No.5 i.e. 12 micron PET/9 micron Al. Foil/37.5 micron LDPE which is >120 days and >120 days at accelerated conditions respectively for ordinary pouches and gas flushed pouches. At standard conditions, this material gives a shelf-life of >365 days & >365 days respectively for ordinary packs and gas flushed packs. Material No.4 i.e. 12 micron MET.PET/37.5 micron LDPE gives a shelf-life of 90 days and 96 days at accelerated conditions in ordinary and gas flushed pouches respectively. At standard conditions, this material gives a shelf-life of 280 days and 292 days respectively in ordinary pouches and gas flushed pouches. Material No.3

i.e. 20 micron BOPP/12 micron PET/37.5 micron LDPE gives a shelf-life of 68 days and 77 days respectively at accelerated conditions in ordinary pouches and gas flushed pouches. At standard conditions, this material gives the shelf-life of 235 days and 255 days respectively for ordinary pouches and gas flushed pouches.

However, the material No.1 & 2 give a much reduced shelf-life ranging from 25days to 40 days in ordinary pouches at accelerated conditions and 33 days to 52 days in gas flushed pouches at accelerated conditions. At standard conditions, the shelf-life ranging from 88 days to 146 days in ordinary packed pouches and 102 days to 160 days in gas flushed pouches.

Annexure-XIII indicates the order of priority/merit of the five packaging materials selected for study based on their performance for shelf-life.

Based on the results obtained from shelf-life studies, the materials recommended to be used for the primary packaging of the product are :

- a) 12 micron PET / 9 micron Al. Foil / 37.5 micron LDPE
- b) 12 micron MET.PET / 37.5 micron LDPE.

The specification of the recommended packaging materials are given at Annexure – XXV.