

L.A. Kashevatskaya,  
V.M. Kopeikovsky,  
Y.M. Kobervein, USSR

## STUDY OF SUNFLOWER SEED DRYING IN CONNECTION WITH BENZ(A)PIREN ACCUMULATION IN SEEDS

In the past 10-15 years many indications have appeared in the literature on the presence of carcinogenic substances in plants and food-stuffs of plant origin. One of such carcinogenic substances is benz(a)piren which is considered to be a criterion of carcinogeneity.

Studies and analyses of different plant oils in many countries have shown that the presence of carcinogenic substances in oils is associated as a rule with the initial material. The sources of carcinogenic substances appearing in oil seeds are the environment as well as the processing operations, particularly seed drying. Our experiments were therefore aimed at studying the influence of combusted fuel, the type of drier, the temperature of agent and duration of the contact of the seeds with the heat agent, on benz(a)piren accumulation in the seeds. Studies were conducted in the laboratory and in production dryers.

In laboratory studies moist seeds were dried in the experimental equipment in the "boiling" layer. The drying agent was the heated air or its mixture with smoke gases obtained by combusting gaseous or liquid fuel.

The content of benz(a)piren in oil seeds was determined by low temperature fluorescent spectroscopy at the wave range of 4000-4100 Å of narrow hydrocarbon fraction obtained by thin layer chromatography; as inner standard 1,12-benzperylene was utilized.

When drying with heated atmospheric air benz(a)piren accumulation was not observed if the air was not contaminated with this com-

pound. In the case of its presence in the air benz(a)piren was accumulated (average for 14 experiments) within the range of 0.22-2.29 mkg/kg, of oil.

In the case of seed drying with the mixture of air and kiln gases obtained from combusting the natural gas, the content of benz(a)piren in the seeds did not increase either.

A mixture of air with kiln gases obtained from liquid fuel combustion was utilised as drying agent under conditions of incomplete combustion of Diesel fuel. Results have shown a sharp increase in benz(a)piren content in seeds, in average up to 49.7 mkg/kg with carcinogene content in kiln gases up to 0.07-0.13 mkg/cub. meter.

Benz(a)piren accumulation in seeds during drying is considerably influenced by duration of the seeds' contact with the drying agent: the longer the duration the larger is the amount of carcinogene in the dried material.

Studies under industrial conditions were carried out on recirculating and shaft driers utilizing liquid fuel, and on rotary and drum driers utilizing liquid fuel, and on rotary and drum driers utilizing natural gas. The results confirmed experimental data obtained at the laboratory. Drying seeds in one-drum driers widely used in the oil and fat industry and in rotary driers with a "boiling layer" of seeds where natural gas is used as fuel did not increase benz(a)piren accumulation in seeds (see Table). It may be concluded that the utilization of natural gas as fuel for drying seeds is safe from the point of view of benz(a)piren accumulation.

Experiments with shaft driers utilizing liquid fuels showed some benz(a)piren accumulation in seeds (the average from 0.21 to 1.43 mkg/kg of oil, ref. Table). In some experiments an increase in the benz(a)piren content did not exceed the mistake of experiment.

Table  
Change of Benz(a)piren Content in Sunflower Seeds Dried  
in Different Driers

Type of drier	Fuel	Temp. of drying agent, °C	Duration of treatment, min	No. of sub-sequent samples	Mean content of benz(a)piren in oil from seeds, mkg/kg		Gain in benz(a)piren content, %
					before dr.	after dr.	
One drum type	Natural gas	240-300	15.0	11	0.19	0.14	0.0
Rotational	Same	180	15.0	3	0.55	0.49	0.0
Tselinnaya 50	TPB	180-200	-	3	Not found	Not found	-
Tselinnaya 30	Diezel	230-255	17-33	3	0.71	0.92	29.6
Tselinnaya 20	Diezel	250-300	-	3	0.89	1.12	25.8
DSP 32	Diezel	75-130	80.0	5	Not found	0.53	-
VTI 8	Diezel	150-190	40.0	3	0.13	1.56	1100.0

The safest drier utilizing liquid fuel, from the point of view of contamination of dried material with carcinogenic carbohydrates, is the "Tselinnaya" type. Experiments with "Tselinnaya-30", DSP-32 and VTI-8 driers showed that high temperatures of the drying agent (about 250°C) and low duration of exposition (17-33 minutes) lead to lower benz(a)piren content.

Shaft driers VTI-8 are the most unfavourable and outdated, and are not utilized for sunflower seed drying in industry.