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Opinion of the Scientific Committee on Food on hydrogenated poly-1-decene

(expressed on 11 July 2001)

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Terms of Reference

To evaluate the safety-in-use of hydrogenated poly-1-decene as a food additive.

Background

Hydrogenated poly-1-decene is proposed as a substitute for white mineral oil. The food additive applications include those of glazing agent for confectionery and dried fruit, and processing aid uses as a lubricant and release agent, especially in bread baking using tins. It has been permitted for use in Finland, and a "Case of Need" has been accepted in the United Kingdom.

Hydrogenated poly-1-decene was evaluated by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in June 1997 but no ADI was allocated. At that time JECFA concluded that considering the potential exposure to humans a complete toxicological profile would be required prior to further review. One major concern of JECFA was the lack of studies on absorption, distribution, biotransformation and excretion (JECFA, 1999). Since then, new information has become available which is reviewed below.

Chemical Aspects

Hydrogenated poly-1-decene, a colourless, odourless and tasteless inert product, is a mixture of aliphatic hydrocarbons each composed of repeated ten-carbon units (oligomers), ranging from C30 to C60. It is synthesised from pure 1-decene, itself made from ethylene which is readily available at high levels of purity. The oligomers are hydrogenated. According to the proposed specifications the range of levels for individual oligomers is the following:

Oligomer	*Distribution %*
<Carbon-30	*≤1.5*
Total Carbon-30	*13-37*
Total Carbon-40	*35-70*
Total Carbon-50	*9-25*
Total Carbon-60	*1-7*

The chemical formula is $C_{10n}H_{20n+2}$, where n=3-6

Hydrogenated poly-1-decene is essentially free of compounds such as naphthenes, aromatics (e.g. benzene) and polycyclic aromatic hydrocarbons. The impurities (not more than 1.5%) are hydrogenated hydrocarbons below C30. The product is thermally and microbiologically very stable, with very low volatility (the boiling range starts only at 320 °C).

Human Exposure

The petitioner states that «the likely exposure will be somewhat smaller than that for mineral oil». Taking an upper figure of 500 mg hydrogenated poly-1-decene per kg bread, based on the maximum mineral oil content of bread to be expected from carry-over (Castle *et al*., 1994) and assuming an average bread intake for the European population of 250 g/person per day (European Commission, 1997), an average exposure of 125 mg hydrogenated poly-1-decene per person can be calculated. The Committee noted that actual exposure is likely to be less than the above estimate, since it assumes that all the bread consumed would be baked in tins. The intake from glazing applications is likely to be at least ten times less than intake from carry over on bread.

Absorption, distribution, metabolism and excretion

Absorption, distribution and excretion have been investigated in the rat (Huntington Life Sciences, 1999).

The test compound was prepared by catalytic reduction, using a mixture of tritium and hydrogen, of a mixture of poly-1-decenes identical to that used in the manufacture of regular hydrogenated poly-1-decene. The radiochemical purity of ^{3}H labelled hydrogenated poly-1-decene used in the studies was >97%. Rats were given single oral doses (30, 120 or 1500 mg/rat) or an intravenous dose (30 mg/rat) of radiolabelled test compound to investigate absorption, toxicokinetics, tissue distribution and excretion. Other rats were given repeated daily oral doses of unlabelled compound (210 mg/rat) over 14 days followed by a single oral dose of labelled compound on day 15 to investigate the influence of repeated dosing. A fourth group of rats with cannulated bile ducts were given a single oral dose of radiolabelled compound (210 mg/rat) to investigate biliary, urinary and faecal excretion.

Very low ^{3}H concentrations were found in plasma after oral or intravenous dosing. The data were fitted to a kinetic model which gave a long half-life consistent with $^{3}H_2O$ in the body water of rats. As expected from tritium exchange, $^{3}H_2O$ accounted for most of plasma radioactivity, especially at 24 hours or more after dosing. At plasma Cmax values for oral dosing, tritium exchange represented about 0.1-0.5% of the dose. Non-volatile radioactivity (^{3}H-hydrogenated poly-1-decene or its metabolites) accounted for only 14-31% of plasma radioactivity. At tissue Tmax values, most of the radioactivity within the carcass was associated with the gastrointestinal tract. The proportion of the dose in, or estimated to be in,

fat, kidneys, lymph nodes and spleen was <0.1% of the dose. Only the liver (at 8 and 24 hrs after the 30 mg dose) contained >0.1% dose, with the proportion decreasing with increasing dose level, as expected for a poorly-absorbed compound. The amounts of radioactivity excreted in the urine (mean 0.16% of dose) and bile (mean 0.01% of dose) were very small. Faeces were the major route of elimination after oral dosing and represented an average of 102.0%, 94.9% and 91.7% of the dose at 30, 210 and 1,500 mg/rat respectively. Absorption of the dose can be estimated by summation of radioactivity present in urine, cage wash and residual carcass (excluding the gastrointestinal tract): the averages were 0.31%, 0.07% and 0.95% for doses of 30, 210 and 1,500 mg/rat respectively. These estimates are <1% in total and represent a value lower than the level of impurities (<3%).

Hydrogenated poly-1-decene is a mixture of inert saturated hydrocarbons. Such substances are not easily metabolised.

Toxicological studies

Acute Toxicity Studies

There are no acute toxicity studies available for the specific material under evaluation. There are data relating to a series of branched chain aliphatic hydrocarbons with carbon chain lengths from C10-C15, with oral LD50 values in rats ranging from 10,000 to 34,000 mg/kg b.w. (Mullin *et al.,* 1990).

28-day Toxicity Study

In a dietary, 28-day study (Pharmaco LSR, 1994), four groups of F-344 rats (5/sex/group) were given hydrogenated poly-1-decene (NEXBASE 2006 FG comprising 32% trimer, 47% tetramer, 17% pentamer, 4% hexamer) at concentrations of 0 (basal diet), 8,000, 20,000 or 50,000 mg/kg food, equivalent to at least 990, 2,480 or 6,240 mg/kg b.w., respectively. The study was conducted as a preliminary trial before a 90-day study (see below). Therefore, no assessment of serum biochemistry or haematology parameters was performed and histology was conducted on liver and mesenteric lymph nodes only.

No treatment-related clinical signs or mortality were observed. At the top dose level there was a modest, non-significant increase in weight gain and food consumption in females; efficiency of food utilisation was unaffected. A slight, but dose-related decrease in absolute and relative weights of the mandibular lymph node was present in both sexes at all dose levels, however this effect attained statistical significance only at the top dose level. Liver and mesenteric lymph nodes were unaffected by treatment either macroscopically or microscopically.

90-day Toxicity Study

In a dietary, 90-day study (Pharmaco LSR, 1996), four groups of F-344 rats (10/sex/group) were given hydrogenated poly-1-decene (NEXBASE 2006 FG comprising 32% trimer, 47% tetramer, 17% pentamer, 4% hexamer) at concentrations of 0 (basal diet), 1,000, 7,000 or 50,000 mg/kg food, equivalent to at least 80, 550 or 4,160 mg/kg b.w., respectively. Two

additional satellite groups of 5 animal/sex each were similarly fed with basal diet and the top dietary concentration of 50,000 mg/kg for 90-day and then withdrawn from treatment for four weeks in order to assess the reversibility of possible effects.

No treatment-related mortality was observed. Animals fed ≥7,000 mg/kg had a higher incidence of soft faeces. Poor hair condition was observed at both lower dose levels. A markedly higher increase of oily and ungroomed coat was observed at 50,000 mg/kg. At the top dose level there was a moderate increase of food consumption in both sexes, without a concurrent increase in weight gain; efficiency of food utilisation was marginally impaired.

At the end of the treatment, slightly high erythrocyte counts, haemoglobin concentrations and marginally higher packed cell volume were observed in males given 7,000 and 50,000 mg/kg. A dose-relationship was evident for haemoglobin concentration; a slightly higher platelet count was observed at the top dose. The majority of the values for the affected parameters were within the normal ranges seen for this age and strain of rats, and the changes were not evident at the end of the reversibility period. In the absence of any changes in the bone marrow they are unlikely to be of toxicological significance. No alterations were observed in serum biochemistry or urinalysis parameters. A slight decrease in absolute and relative liver weight was present in males at all dose levels, however this effect attained statistical significance only at the top dose level. A slightly increased incidence of isolated necrotic hepatocytes was present in females at 50,000 mg/kg. No other organs were affected by treatment either macroscopically or microscopically. In the satellite group, poor coat and hair loss and slightly increased food consumption were observed up to the end of the 4-week withdrawal period. On the other hand, no effects on haematology or liver were observed at the end of the 4-week withdrawal period. Histopathological examination of tissue samples (lymphoid, gastro-intestinal, hepatic and splenic tissue) did not reveal any accumulation. Liver and mesenteric lymph nodes were unaffected either macroscopically or microscopically. In conclusion, the exposure for 90 days to a dose of hydrogenated poly-1-decene equivalent to at least 4,160 mg/kg b.w., induced only slight effects on the appearance of the coat, haematology and liver. Therefore, an intermediate dose level of 7,000 mg/kg food, equivalent to at least 550 mg/kg b.w., was identified as a no-observed-adverse-effect-level (NOAEL).

Genotoxicity Studies

No study has been undertaken with the specific product under review. In earlier published studies, lower molecular weight isoparaffins (C11-C13, C10-C11, C10-C13) were not genotoxic in several *in vitro* and *in vivo* assays (Mullin *et al.*, 1990).

Other studies

No studies have been undertaken on reproduction, developmental toxicity, chronic toxicity or carcinogenicity. Lower molecular weight isoparaffins were not embryotoxic or teratogenic (Mullin *et al.*, 1990).

Conclusions

Absorption, distribution and excretion studies in the rat, using oral doses of tritium-labelled hydrogenated poly-1-decene, have indicated that this material is poorly absorbed (less than 1%) from the gastrointestinal tract. The limited amount of absorbed radioactivity detected in plasma and tissues was present largely in the form of $^{3}H_2O$, probably arising from tritium exchange with body water . While these studies are not ideal, because of the tritium exchange with body water, the data are compatible with the expected low absorption predicted from the molecular weight distribution of the product (not more than 1.5% with carbon chain length less than C30). Furthermore, there is no indication from the oral feeding studies in rats of accumulation in tissue samples (e.g. lymphoid tissue), which is known to occur with some mineral hydrocarbons, nor were proliferative changes observed.

Chronic toxicity, carcinogenicity, genotoxicity, reproduction and developmental toxicity studies have not been undertaken. However, in earlier published studies, lower molecular weight isoparaffins were non-genotoxic in a number of short-term tests at gene and chromosome level, and were not embryotoxic or teratogenic. Based on considerations of chemical structure and metabolism, it is reasonable to assume that the higher molecular weight saturated hydrocarbons behave similarly.

The results of the 90-day rat oral feeding study indicated only slight effects on the appearance of the coat, haematology and liver at the highest dose of 4,160 mg/kg b.w.. A NOAEL of 550 mg/kg b.w. can be identified. The Committee applied an uncertainty factor of 100 to the NOAEL and established an ADI of 0-6 mg/kg b.w. . Recently, JECFA allocated an ADI of 0-6 mg/kg b.w. to hydrogenated poly-1-decene (JECFA, 2001).

References

Castle L., Nichol J. and Gilbert J. (1994). Migration of mineral hydrocarbons into foods. 4. Waxed paper for packaging dry goods including bread, confectionery and for domestic use including microwave cooking. Food Addit. Contam. **11** (1):79-89.

European Commission (1997). Improvement of knowledge of food consumption with a view to protection of public health by means of exchanges and collaboration between database managers. Food Science and Techniques. Reports on Tasks for Scientific Co-operation. Report of experts participating in task 4.1. European Commission, Directorate-General Industry, Brussels, EUR17528.

JECFA (1999). WHO Technical Report Series 884. Evaluation of Certain Food Additives and Contaminants. Forty-ninth report of the Joint FAO/WHO Expert Committee on Food Additives. Rome, 17-26 June 1997. World Health Organisation, Geneva.

JECFA (2000). WHO Technical Report Series 896. Evaluation of Certain Food Additives and Contaminants. Fifty-third report of the Joint FAO/WHO Expert Committee on Food Additives. Rome, 1-10 June, 1999, 16-18.

JECFA (2001). Summary of the fifty-seventh meeting of the Joint FAO/WHO Expert Committee on Food Additives. Rome, 5-14 June, 2001, 2.

Huntington Life Sciences (1999). 3H-NEXBASE 2006 FG (^{3}H-HYDROGENATED POLY-1-DECENE). Absorption study in the rat after single and repeated doses. Final Report: NEY 014/98-4811, 10 February 1999. Sponsor: Neste base Oils (Finland). As submitted by Whitehouse (1996).

Mullin L.S., Ader A.W., Daughtrey W.C., Frost D.Z. and Greenwood M.R. (1990). Toxicology update isoparaffinic hydrocarbons. A summary of physical properties, toxicity studies and human exposure data. J. Appl. Toxicol. **10**: 135-142.

Pharmaco-LSR Ltd. (1994). NEXBASE 2006 FG: Preliminary toxicity study by dietary administration to F-344 rats for four weeks. Final Report: 93/NEY001/1140, 7 March 1994. Sponsor: Neste Alfa OY (Finland). As submitted by Whitehouse (1996).

Pharmaco-LSR Ltd. (1995). NEXBASE 2006 FG: Toxicity study by dietary administration to F-344 rats for 13 weeks followed by a four-week reversibility period. Final Report 95/NEY002/0090, 3 July 1995. Sponsor: Neste Alfa OY (Finland). As submitted by Whitehouse (1996).

Whitehouse B (1996). Application for evaluation of hydrogenated poly-1-decene. Submitted to the European Commission by Brian Whitehouse Associates. 6 December 1996 (SCF Dossier 158.01) and subsequent updates.