Evaluation of the transition of DDT and its metabolites into liquid extracts and tinctures from medicinal plant materials

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SUMMARY

Using gas-liquid capillary chromatography and gas chromatography-mass spectrometry, the content of DDT and its metabolite DDE was determined in 49 official phytopreparations (liquid extracts and tinctures) from yarrow herb, thyme herb, nettle leaves, viburnum fruits and hawthorn fruits. It was found that the absolute concentration of DDT in liquid extracts and tinctures reached 0.45 ng / g, DDE - 3.07 ng / g. The transfer of toxicants from raw materials to alcohol dosage forms did not exceed 16% for DDT and 68.94% for DDE. With an increase in the concentration of the pesticide in plant raw materials, its transition to liquid extracts and tinctures decreased. The results obtained did not exceed the permissible levels of DDT and its metabolites in plant-based dietary supplements.

DDT (dichlorodiphenyldichloromethylmethane) belongs to the most dangerous organochlorine pesticides, which were quite intensively used in the world until the beginning of the 60s of the XX century [2; 3]. Despite the long ban on its use, this pesticide, due to the peculiarities of its chemical structure, continues to be found in environmental objects at the present time [2]. Studies have shown that medicinal plants are capable of accumulating DDT and its metabolite DDE (dichlorodiphenylchlorethylene) [1]. Therefore, medicinal plants and dosage forms from them (extracts, tinctures, decoctions and infusions) can be possible sources of the above pesticide entering the human body.Taking into account the toxicity of these compounds and the potential danger to human health, the question of the degree of transition of DDT and its metabolites into dosage forms is highly relevant.

The purpose of this study is to study the transition of DDT and its metabolite DDE into liquid extracts and tinctures from plant raw materials harvested within the same region. To implement this, the content and degree of extraction of DDT and DDE into liquid extracts and tinctures prepared from raw materials with known concentrations of toxicants were determined.

The object of the study was the raw material of medicinal plants, which, on the one hand, have a rich raw material base in the Altai Territory, and on the other hand, are the raw material for obtaining official alcoholic extracts (yarrow herb, thyme herb, nettle leaves, viburnum fruits, hawthorn fruits), Raw materials were procured on the territory of the Rubtsovsky district of the Altai Territory in the summer - autumn of 1999-2000. in accordance with the existing rules [5; 7]. Phytopreparations were prepared at the Unipharm plant (Barnaul) in accordance with the requirements of the relevant FSP. A total of 43 samples of raw materials, 43 liquid extracts and 6 tinctures were analyzed.

The content of DDT and its metabolites in the objects of study was determined by the methods of gas-liquid capillary chromatography and gas chromatography-mass spectrometry [4] using Chulett-Pakkard equipment (gas chromatography-mass spectrometric system, HP 5890A gas chromatograph with an electron capture detector). The analysis of research objects was carried out in an accredited analytical center

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The study of the DDT content in liquid extracts and tinctures showed that this pesticide is found unchanged in only 20.4% of the investigated alcoholic extracts (Table 1). The concentration of DDT in them varied in the range of 0.02-0.44 ng / g. DDT was not detected in liquid extracts of yarrow herb and thyme herb, as well as in most of the studied liquid extracts of nettle leaves and viburnum fruits.High, compared to other extracts, DDT content was noted in liquid extracts and tinctures from hawthorn fruits.

The degree of conversion of DDT into alcoholic recoveries in most cases did not exceed 15.2% (Table 2), The exception was the liquid extract of hawthorn fruits and 2 tinctures of hawthorn fruits, where the transition was, respectively, 22.4, 48.89 and 64%.

Table 1

Content of DDT and DD E in liquid extracts and tinctures (in ng / g)

Name of LPC and LF	n	DDT, ng / g		DDE, ng / g	
		NSwednesday - -NS	R	NSwednesday - -NS	R
Yarrow Herb Liquid Extract	fourteen	0	0	0.04 ± 0.003	0-0.23
Thyme herb, liquid extract	2	0	0	-	0.006-0.012
Nettle leaves, runny extract	15	0 *	0-0.04	0.06 ± 0.005	0.02-0.68
Viburnum fruit, liquid extract	6	0 *	0-0.08	0.25 ± 0.02	0-0.43
Hawthorn fruit, liquid extract	6	0.08 ± 0.005	0-0.44	0.13 + 0.01	0-0.44
Hawthorn fruit, tincture	6	-	0-0.44	0.51 ± 0.06	0.03-3.07
Total:	49	-	0-0.44	-	0-3.07

Note:

0 - pesticide content <0.02 ng / g,n is the number of samples,

R is the range of variation,

0 * - content less 0.1 ng / g in most samples;a dash means that the average was not calculated.

table 2

The degree of transition of DDT and DDE from plant raw materials to liquid extracts and tinctures (in % of the content in the raw material)

Name of LPC and LF	n	DDT,%		DDE,%	
		NSwednesday - -NS	R	NSwednesday - -NS	R
Yarrow Herb Liquid Extract	fourteen	0	0	3.75 ± 0.28	0-32.0
Thyme herb, liquid extract	2	0	0	-	4.17-6.0
Nettle leaves, runny extract	15	0 *	0-6.29	4.50 ± 0.45	1.24-33.78
Viburnum fruit, liquid extract	6	0 *	0-15.20	42.40 + 3.17	0-45.42
Hawthorn fruit, liquid extract	6	5.76 ± 0.53	0-22.4	31.77 ± 3.25	0-40.67
Hawthorn fruit, tincture	6	-	0-64.0	54.94 ± 4.41	6.4-68.94
Total:	49	-	0-64.0	-	0-68.94

Note:

0 - content <0.2 ng / gn is the number of samples,

R is the range of variation,

0 * - content less 0.1 ng / g in most samples;a dash means that the average was not calculated.

As seen from Fig. 1, in the overwhelming majority of extracts (89.8%), the absolute concentrations in liquid extracts and tinctures did not exceed 0.1 ng / g if the DDT content in the feedstock was less than 4.5 ng / g. However, in some extracts (6.1%), pesticide concentrations reached 0.30-0.45 ng / g. At the same time, even for such a small sample, there was a tendency towards a decrease in the concentration of DDT in herbal remedies.

The data presented in Fig. 2 show that the degree of conversion of DDT into liquid extracts and tinctures in most cases did not exceed 15.2%, when the pesticide content in the medicinal plant was less than 2.4 ng / g. It was found that from raw materials with a higher DDT content (hawthorn fruits), the transition of the pesticide to alcoholic extracts was reduced to 5%. The results obtained showed that the transition of DDT into liquid extracts and tinctures is relatively higher when the pesticide content in the medicinal plant is 1.0 - 2.4 ng / g (hawthorn fruits, viburnum fruits). It was found that the degree of conversion of DDT into hawthorn fruit tinctures is higher in comparison with liquid extracts, which is obviously due to technological features.

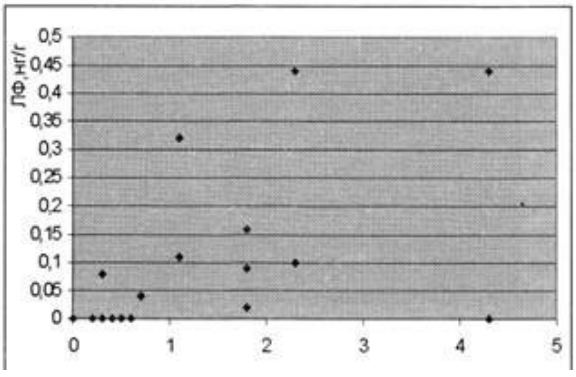


Fig. 1. The content of DDT in liquid extracts and tinctures, depending on the content in raw material

Legend: abscissa - pesticide content in medicinal plant raw materials, ng / g; along the ordinate - pesticide content in liquid extracts and tinctures, ng / g.

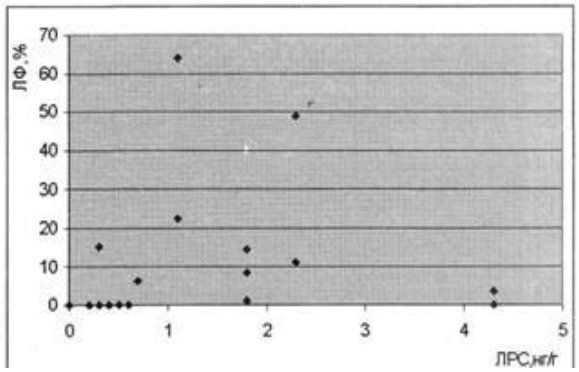


Fig. 2. The degree of conversion of DDT into liquid extracts and tinctures, depending on content in raw materials (in% of the original content in raw materials)

Designations: abscissa - content in medicinal plant raw materials, ng / g; on the ordinate - the degree of transition to liquid extracts and tinctures,%.

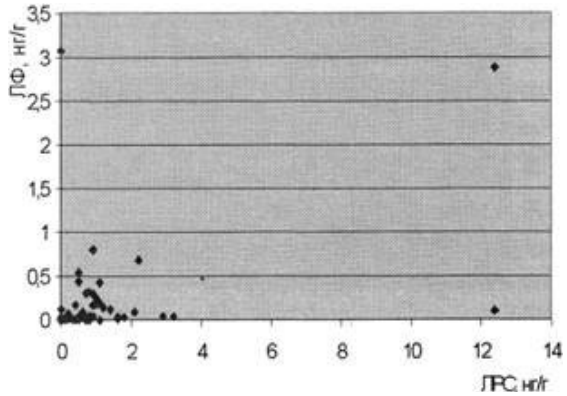
The DDT metabolite - DDE - is present in the overwhelming majority of liquid extracts and tinctures (Table 1). Its concentration was not found only in 6.1% of the investigated alcoholic extracts. The average content of DDE in liquid extracts was in the range of 0.01-0.25 ng / g, and in tinctures it reached 0.51 ng / g. The lowest values were found in liquid extracts from herbs and leaves, and the highest in liquid extracts from fruits. The average DDE content in hawthorn fruit tinctures was 3.07 ng / g, which is 7 times higher than the maximum concentration in liquid extracts of hawthorn fruit.

The degree of conversion of DDE into liquid extracts and tinctures reached 68.94% (liquid extracts of viburnum fruits and hawthorn fruit tinctures) (Table 2). Average values of the degree of transition varied in the range of 4.50-54.94%. At the same time, the values of the degree of transition for liquid extracts from herbs and leaves were comparatively lower than for liquid extracts and infusions from fruits. The extraction of the pesticide in the hawthorn fruit tinctures was 1.7 times higher than in the liquid extracts.

The results shown in Fig. 3 and fig. 4, clearly showed that when the content of DDE in the raw material is not more than 2.0 ng / g, the concentration of the pesticide in liquid extracts and tinctures predominantly does not exceed 0.4 ng / g. At the same time, in 63.4% of the studied liquid extracts and tinctures, the DDE concentration did not exceed 0.10 ng / g, and only in 4.1% of the extracts did they reach concentrations of more than 0.81 ng / g.

It was found that with the same DDE content in the medicinal product (no more than 2 ng / g), there are 2 ranges of values of the degree of transition: 0-14.0% (for liquid extracts from herbs and leaves) and 32.0-50.0% (for liquid extracts and infusions from fruits) (Fig. 4). Obviously, at the same concentration level in the medicinal product, the degree of DDE conversion into liquid extracts and tinctures depends mainly on the type and morphological group of the raw materials used.

Thus, the absolute concentration of DDE in the extracts and tinctures decreased when the toxicant content in the starting material was higher than 0.5 ng / g, which cannot be said about the DDT concentrations (Fig. 1 and Fig. 3). Comparative analysis of the data on the relative content of DDT and DDE in tinctures and liquid extracts showed a clear decrease in the degree of conversion of DDE into alcoholic extracts with an increase in its concentration in the raw material; for DDT, this dependence is practically absent (Fig. 2 and Fig. 4).



Rice. 3. The content of DDE in liquid extracts and tinctures, depending on the content in raw materials

Legend: abscissa - pesticide content in LPC, ng / g; along the ordinate - content in liquid extracts and tinctures, ng / g.

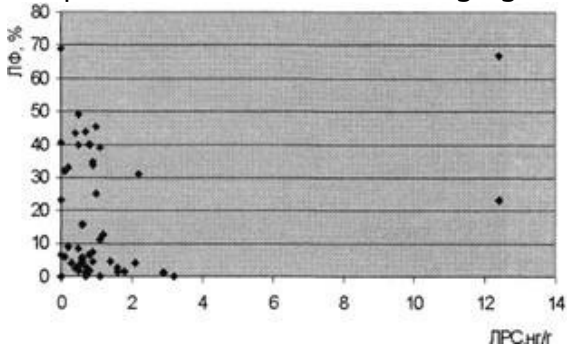


Fig. 4. The degree of conversion of DDE into liquid extracts and tinctures, depending on the content in the raw material (in% of the original content in the raw material)

Legend: abscissa - content in LPC, ng / g; on the ordinate - the degree of transition to liquid extracts and tinctures,%.

Another metabolite of DDT - DDD - was not found in raw materials and alcoholic extracts / Since there are currently no permissible levels of pesticides for medicinal plant materials, the permissible levels of DDT and its metabolites in dietary supplements on a plant basis, adopted in the Russian Federation, were used as indicative criteria [6]. The investigated raw materials and phytopreparations contained the above pesticides in quantities significantly lower than the available permissible levels for plant-based dietary supplements, therefore, they can be recommended for medical use.

CONCLUSIONS

1. Methods of gas-liquid capillary chromatography and chromatography-mass spectrometry studied the content of DDT and its metabolites in extracts and tinctures from yarrow herb, thyme herb, nettle leaves, viburnum fruits and hawthorn fruits harvested in the Altai Territory.

2. It has been shown that the absolute concentrations of DDT and DDE are significantly lower than the available ones. acceptable levels of these toxicants for plant-based dietary supplements. The degree of transfer of toxicants into herbal remedies decreases with an increase in the content in the feedstock.

CONCLUSION

Thus, the conducted studies of liquid extracts and tinctures from raw materials of the Altai Territory showed that they do not contain vital concentrations of DDT and its metabolites and, therefore, can be recommended for use in medical practice.

LITERATURE

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