POTENTIATION OF ^{90}STRONTIUM BIOLOGICAL ACTION ON AN ORGANISM BY AGRICULTURAL CHEMICALS

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Analysis of investigations on determining the mode of binary mixture (^{90}Sr and DDT) action at its long-term administration daily to an organism showed that for this purpose quantitative data only are insufficient, especially in those cases when integral findings and possible effects are criteria. Accordingly, to elicit difference between components and binary mixture effect rate on the weight increase, duration of life and intensity of tumour output by quantitative evaluation only is of great difficulty. The quantitative evaluation with due regard for qualitative peculiarities of occurring effects and time of their appearance permits to elicit the ^{90}Sr biological action potentiation by the chemical (DDT) at their combinative long-term administration to an organism.

Presence of ^{90}Sr and DDT in the environment, their high migratory capacity and the possibility of combined human intake caused the necessity for evaluation of consequences not only isolated ^{90}Sr and DDT effect on an organism but combinative disturbance forms. The purpose of the given study was to define the mode of binary mixture (^{90}Sr and DDT) action when it was administered orally on a daily shedule to animals. 200 white rats inbred with the primary weight of I40 $\pm$ I5 g were used in experiments. Compounds were cannulated in rats i.p. in such dosages: 0.3μCi of ^{90}Sr (group I), 0.2 mg of DDT (group II), 0.8 ml of binary mixture containing 0.3μCi of ^{90}Sr and

0.2 mg of DDT (group III) and 0.3 ml of vegetable oil (group IV).

During 186 days 55.8 μ Ci of ^{90}Sr (groups I and III), 37.2mg of DDT (groups II and III) and 55.8 g of vegetable oil were administered to animals.

Materials and Methods

^{90}Sr storage in rat skeleton for groups I and III resulted in increasing not only dose rate from 4.0 up to 12.8 rads per day (by the 30th day and the 186th day after radioactive label injection, respectively) but the adsorbed dose per animal skeleton from 71.5 rads (by the 30th day after injection) up to 1482 rads by the last injection day.

In the further study (up to the death of animals for groups I and III) the dose rate reduced gradually. The dose by the above date was 6.6-6.9 rads/day.

By the end of study the adsorbed dose was 4,488 (group III) and 4,953 rads (group I).

During the study period the rats weight for groups I and III was lower than for controls. At the same time rats of group III had invariably the minimum weight. Annual increase of animals weight for this group was 100$\pm$ 10 g and for groups I and II was 130 $\pm$ 10 g.

For the last study weeks the rats weight for group III was 180 $\pm$ 15 g, and for group I and for group II was 250 $\pm$ 20g. It is characteristic that the rats weight increase for group III was stopped by the 220th day, for group I and II by the 360th day, for controls only by the 450th day.

Duration of study rat life was 580 days for group I, 462 days for group II, 330 days for group III, and 720 days for controls.

Over a two-year study period there was only one hypophysis innocent tumour in the control group. The tumour output was diagnosed by the 760th day of the study.

The primary tumour for group I was observed by the 488th day. In the following 145 days 4 tumours of internal organs, one osteosarcoma, and a milk gland fibroadenoma have also been diagnosed. Additionally, at morphological studies of marrow and thigh bones 2 presarcomas (by the 575th day) and 3 leucosis (by the 488th day) were found. The adsorbed dose per skeleton was 3,900 rads by the time of the primary tumour and 2 leucosis revealed. Eighteen rats survived before the primary tumour determined. The primary tumour for group III was diagnosed by the 300th day when the adsorbed dose per skeleton was 3,000 rads.

In the following 333 study days 5 tumours of internal organs, 2 osteosarcomas, 4 presarcomas, and 5 leucosis for group III were observed. There was no tumour for group II during the study period.

Quantitative erythrocytes changes for group I and III were observed during the study period. At the same time thrombocytes and reticulocytes increase were primarily observed. By the end of the study second month marked reticulocytopenia and thrombocytopenia were developed.

Quantitative leucocytes shifts were revealed by the 30th day after ^{90}Sr and binary mixture injection.

Leucopenia instead of leucocytosis was developed by the 100th day. Changes of the number of morphous blood elements for group I were 15-20% higher than for group III.

During the first 3 study months peripheral blood picture did not differ when compared with controls.

In the following months the number of white and red blood cells for group III was 15-18% lower than for controls.

Activity of serum alkaline phosphatase, osseous tissue

and internal organs for groups I-III was changed homogenously having difference only in quantitative relation.

During the study period (the 30th, 100th, 187th, and 450th day) activity of serum alkaline phophatase, osseous tissue, and organs for group III was higher than for group I in spite of DDT (group II) constantly caused the intensive enzyme inhibition.

Results

It is impossible to determine the mode of binary mixture action due to only quantitative evaluation of integral findings (animal weight and duration of life). At the same time it is possible to speak about the chemical effect on ^{90}Sr potentiating action taking into consideration temporary evaluation on each of the findings. Thus, discontinuance of weight increase for group III has become 230 days earlier than for the control group and 50 days earlier than for both groups I and II.

The death 50% of rats for group III has become 440 days earlier than for the control group and 10 days earlier than for both groups I and II.

It is impossible to demonstrate that the chemical potentiates the ^{90}Sr action on hematosis state by evaluating only the quantitative shifts in morphous blood elements for groups I, II, and III. However, leucosis frequency for group III (5 cases; 3 of them are in combination with internal organs tumours) and for group I (3 cases; 2 of them are in combination with tumours) can be evidence for the assertion of intensification ^{90}Sr action on hematosis organs.

The number of malignant tumours of internal organs and flexible tissues for group I and III was identical. Meanwhile, 4 numerous tumours of 6 (group III) and I from 6 (group I) were occurred in rats.

Additionally, 5 rats of 6

(group III) and 3 rats of 6 (group I) had tumours in combination with other effects.

In a year after ^{90}Sr and DDT injection was stopped, 3 rats (group I) and 6 (group III) were died from malignant neoplasms and leucosis. Rats for group I and III compared showed no significant differences in the number of osteosarcomas (one for group I, two for group III). However, 2 presarcomas were found for group I, 4 for group III.

Thus, it is insufficient to have available information about the quantitative evaluation of arising effects to determine the mode of binary mixture action and specification of its components activity.

As the results obtained, temporary and qualitative evaluation, which should be used as criteria for determining the mode of such a combinative action, may be significant additional data.

The data presented here permit to specify simultaneously the activated mixture component. In the case reported the presence of the chemical in mixture produced activation of ^{90}Sr effect on some functions of living beings including the hematosis function and enzyme activity.

Additionally, the DDT presence stimulates the ^{90}Sr blastomogenic activity that resulted in the greater frequency of appearance of numerous tumours and combinations with other effects.