

Bioassay study of released compounds to assess the safety of popular children's toys

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INTRODUCTION & AIM

Various polymers are used to produce goods for people, particularly toys for children. To improve the properties of the material, such as plasticity, flame resistance or recyclability, different additives are included into the material composition (Cuthbertson et al., 2024). However, besides improving their characteristics these compounds can be significantly harmful to human health: for example, phthalates increase the flexibility of materials and can lead to damage of the internal organs (liver, kidney) (Wang & Qian, 2021) and endocrine and metabolic effects (Casale & Rice, 2023); polybrominated diphenyl ethers are used as flame retardants and can negatively affect the endocrine system (Xue et al., 2023). Thermoplastic rubber is a class of material that combines characteristics of rubber and plastic and is made from styrene and butadiene. It is characterized by its resistance to weathering and chemicals, flexibility and has a wide range of applications, including in gloves, electronics, toys, footwear, automotive industry etc. (Jansen, 2016). Thermoplastic rubber children's toys are popular anti-stress squash toys. However, when they are used, emission of substances is observed, and the toxicity of such toys and their safety for children's health are unknown. Therefore, the aim of this study was to study the toxicity of popular anti-stress squash toys by biotesting with *Lepidium sativum* L. to assess the risks to children's health.

METHODS

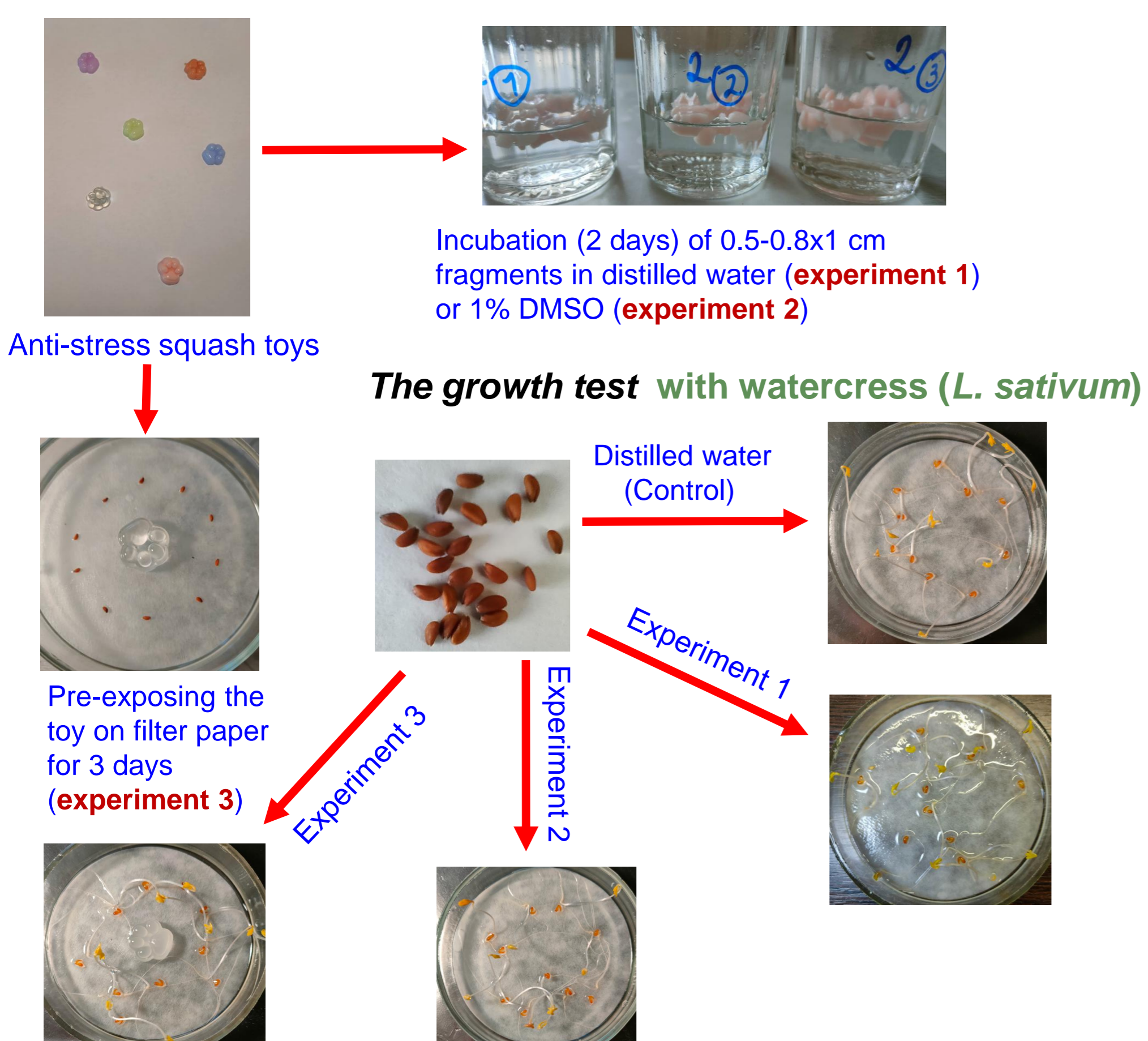


Figure 1. Scheme of the experiment to study the toxicity of anti-stress squash toys with *L. sativum*

The germination energy (%) of the seeds of *L. sativum* (on the 3rd day), germination (%), biometric and morphometric indices of seedlings (length of roots and shoot) were evaluated on the 5th day from the start of the experiment.

RESULTS & DISCUSSION

Table 1. Seed germination parameters of *L. sativum*

Experiment option	Germination energy, % relative to control			Seed germination, % relative to control		
	Experiment 1	Experiment 2	Experiment 3	Experiment 1	Experiment 2	Experiment 3
Control	100	100	100	100	100	100
DMSO, 1%	-	100±0	-	-	100±0	-
Colorless	100±3	100±0	97±3	100±3	100±0	97±3
Pink	100±0	97±3	93±3	103±0	97±3	93±3
Blue	104±3	97±3	100±0	100±3	97±3	100±0
Green	100±0	-	100±0	103±0	-	100±0
Lilac	100±0	-	93±7	103±0	-	93±7
Brown	104±3	97±3	100±0	103±0	97±3	100±0

Table 2. Biometric and morphometric indicators of *L. sativum* seedlings

Experiment option	Root length, % relative to control			Stem length, % relative to control		
	Experiment 1	Experiment 2	Experiment 3	Experiment 1	Experiment 2	Experiment 3
Control	100	100	100	100	100	100
DMSO, 1%	-	121±4*	-	-	101±2	-
Colorless	108±6	93±7**	100±3	98±190	95±5	93±3
Pink	107±6	111±4	96±5	103±4	98±3	92±4
Blue	114±4	107±6	95±3	97±4	102±3	88±2*
Green	110±8	-	92±4	95±4	-	92±3
Lilac	105±8	-	88±5	100±2	-	93±3
Brown	116±6	114±5*	88±5	98±4	98±3	85±2*

Note: * – The difference compared to the control is significant at $p \leq 0.05$;
** – The difference compared to the DMSO (1%) is significant at $p \leq 0.05$.

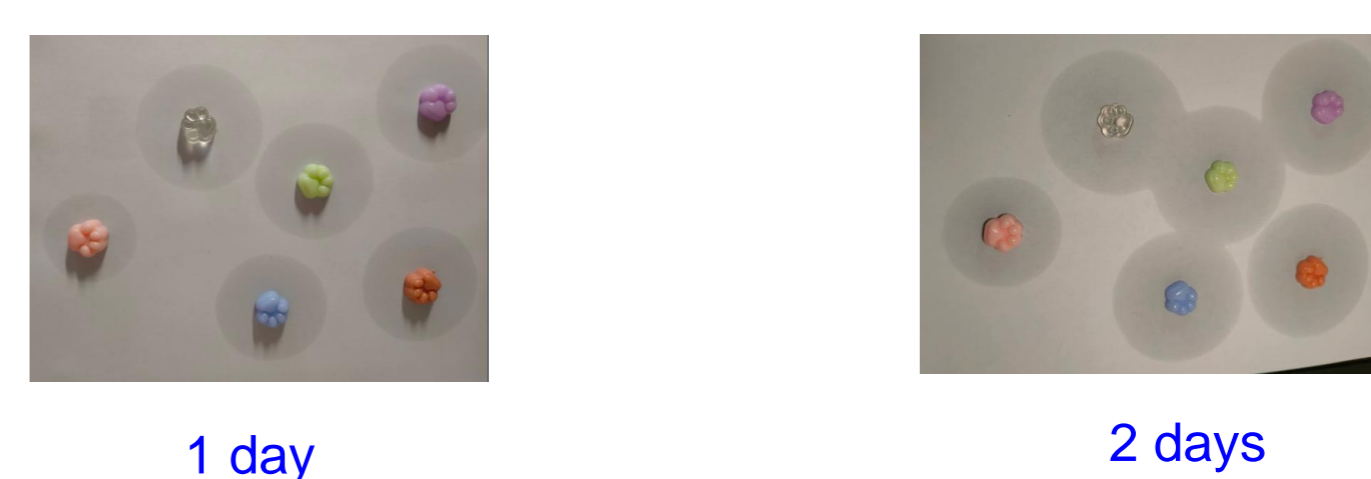


Figure 2. Toys placed on paper

CONCLUSION

The obtained data indicate the biosafety of water-soluble mixtures secreted by the studied children's toys.

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