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Survey and risk assessment of chemical substances in non-biocidal antifouling paints for private pleasure boats

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Non-biocidal antifouling coatings for pleasure boats are promoted as environmentally better alternatives to biocidal antifouling products. Even though these products do not contain biocides, they may contain other hazardous substances. This study aims to clarify if there are functional, non-biocidal alternatives to biocidal antifouling paints on the Danish market and to investigate the potential environmental and health risks associated with them. The study comprises a survey of non-biocidal antifouling coatings, chemical analyses as well as risk assessments of selected products.

65 coatings marketed as non-biocidal antifouling coatings were found on the Danish market. A total of 28 individual substances was identified as hazardous based on information from the products' material safety data sheets, equalling roughly 50% of all identified substances. Most commonly, the hazardous substances are solvents, which are also used in biocidal coatings.

13 of the 65 products were prioritised for targeted chemical analyses and risk assessment. The basis for the selection was the coatings' availability on the Danish market and the hazardous profile of their containing substances. Seven substances were selected for the consumer risk assessment: solvent naphtha, ethylbenzene, naphthalene, rosin, octamethylcyclotetrasiloxane (D4), 4-methylpentan-2-one (MIBK) and 4-methylpentan-2-one oxime. In the environmental risk assessment, cyclosiloxanes (D4, D5 and D6), medium-chain chlorinated paraffins (MCCP) and zinc oxide were in focus.

The risk assessment methodology used for biocidal antifouling products was adopted for the non-biocidal antifouling coatings in order to allow for a comparison of the risks related to biocidal and non-biocidal coatings.

The human health risk assessment focused on consumer uses of the antifouling coatings. Exposure estimates were compared to health reference values for the general population. Five of the 13 non-biocidal antifouling coatings contain hazardous substances for which the health risks cannot be regarded as controlled. The two substances causing the potential health risks are MIBK and 4-methylpentan-2-oxime. MIBK is a common solvent in coatings and thus not specific to non-biocidal coatings, while the presence of 4-methylpentan-2-oxime is linked to the foul release mechanisms of certain non-biocidal antifouling coatings.

The environmental risk can be anticipated to be controlled for the harbour water and the sediment compartment based on calculated risk quota below 1. Nonetheless, D4, D5, D6 and MCCP are recognized as PBT/vPvB substances and the use of products potentially leading to environmental releases of such substances should be discouraged.

In conclusion, non-biocidal antifouling products, which can be regarded as safe for both human health and environment, are available. However, health risks related to the use of some non-biocidal antifouling products cannot be excluded.

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Calculation and comparative hygienic assessment of potential risks when processing agricultural crops using 3RIVE3D technology

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The use of chemical plant protection agents plays an important role in the agricultural sector of the country for the establishment of stable economic growth and the fulfillment of the state's development goals. However, incorrectly selected application methods, inappropriate spraying equipment, poor maintenance of pesticide application equipment, low quality knowledge of workers regarding the safety of the pesticides' application can lead to acute and chronic occupational health disorders.

The aim was calculation and comparative hygienic assessment of potential risks when treating agricultural crops using 3RIVE3D technology.

Materials and methods: 3Rive 3D Application System is a revolutionary crop protection platform that empowers growers to farm more extensively. The system integrates formulation technology, application technology and active ingredients to efficiently cover a larger treatment area in a shorter period of time with fewer refills, saving water, fuel, labor and time.

Field experiments on the study of working conditions when using the Brigade 3Rive 3D, SC formulation was conducted in various soil

and climatic regions of South-East Europe under acceptable meteorological conditions.

Results and discussion: Inhalation risk for workers involved in treatment using the 3Rive3D technology mostly did not differ from this risk for workers using other methods of treatment.

The real dermal risk was significantly lower compared to the risk of workers involved in aerial processing and UAV processing ($p=0.009$–0.048 according to Wilcoxon's W-test); compared to others, it was insignificantly lower ($p=0.262$–1.000). There was a similar picture in comparison with the dermal aggravated risk – significantly lower in comparison with the risk for workers involved in air processing and processing with the unmanned aerial vehicles ($p=0.009$ according to Wilcoxon's W-criterion); compared to others, it was insignificantly lower ($p=0.262$–1.000).

The significant difference in the complex real and aggravated risks was significantly higher for the tractor driver compared to the corresponding risk of the mixing unit operators during rod processing ($p<0.001$ according to the Wilcoxon W-test), since the inhalation risk had the main weight in the formation of the complex risk.

Conclusion: It was established that in real conditions, applying pesticides using 3Rive 3D innovative technology in compliance with the recommended agrotechnical and hygienic regulations for safe application does not exceed hygienic standards in the air of the working and drift zones, and it is proven that the potential risk of harmful impact on the agricultural workers body in the case of complex intake through the skin and respiratory tract did not exceed 1 c.u., and therefore is permissible, which allowed to recognize their working conditions as satisfactory.

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Combining chemical, biological similarity and metabolite data in read-across approach

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Identifying relevant source chemicals (SCs) is a major challenge in read-across (RAX) assessment. The RAX assessment workflow developed as part of an EFSA funded project (OC/EFSA/SCER/2021/04), integrates information on chemical and biological properties, as well as information on metabolites, to better define relevant SCs. The read-across assessment is performed using the rodent *in vivo* endpoint data from the SC, related to repeated-dose toxicity and prenatal developmental toxicity with oral route of exposure. For this purpose, a project database has been built to store different toxicity studies. Data rich compounds are pesticide active substances and metabolites from triazoles, triazine and carbamates.

One compound from triazole compound class – Propiconazole– was selected as target compound (TC) to explore the performance of the developed read-across workflow. The developed workflow explored three different approaches to generate SC: i) chemical similarity, ii) biological similarity and iii) metabolites. Twenty-seven pesticides from triazole compound class were selected as a reference group with a clear toxicological profile. Structural information was used to identify the relevant SC regarding their chemical properties. For the NAM data, ToxCast summary data consisting of information regarding assay (in) activities were used to calculate the biological similarity. In the first approach, the combination of chemical and biological similarity calculated from ToxCast data identified the majority of reference group compounds and was particularly successful with integrated background knowledge of TC mode of action. The second approach used biological similarity as starting point, which resulted in an overwhelming number of candidate SC originating from diverse compound classes, which was subsequently refined by integrating chemical similarity. The third approach applied shared or similar metabolites from observed *in vivo* data, which efficiently generated SCs mostly only from triazole reference group compounds.

Both integration or modular combination of ii) biological similarity and iii) metabolites information achieved an improvement in the SC selection compared to only considering i) chemical similarity. Moreover, all these approaches can serve as a starting point for the identification of SCs. The developed workflow can support the identification of SCs and could be integrated in future guidance for the RAX of endpoints identified from repeated-dose and prenatal developmental toxicity studies.

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Risk characteristics of alimentary cumulative effects of pesticide residues in food products (based on monitoring results)

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Modern agricultural technologies involves the use of a whole range of pesticides. Therefore, the control and toxicological assessment of multiple pesticide residues in food is one of the urgent tasks of food safety.

The aim of the study is to characterize the exposure and assess the risk from the acute alimentary cumulative effects of pesticide residues in some widespread food products.