

Artificial turf pitches – an assessment of the health risks for football players and the environment.

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Summary

Artificial turf is used for football pitches around the world. The turf has many advantages, being hard-wearing and easier to maintain than natural grass. The use of artificial turf also allows the football season to be extended, independently of the weather.

Artificial turf often contains rubber granulates from waste tyres, which contains many chemical substances of very high concern to human health and the environment. The concentrations of these substances are however extremely low, they are only leached from the rubber granulate in very small quantities and they are only present in low concentrations in the hall air. The quantities of this type of substance are consistently lower in the other types of rubber granulate which are used (e.i., EPDM rubber). The assessment of health risk was therefore based on measurements (concentrations in the rubber granulate and in airborne dust, PM10, and volatile organic compounds (VOC) in the hall air) in halls in which recycled rubber granulate is used.

A number of worst case scenarios were prepared which are used in the human health risk characterisation. These scenarios are based on information concerning the use of the halls [matches and training sessions; frequency and duration; physiological parameters (skin surface area, inhalation volumes during exertion and body weight) and analyses (content in rubber granulate, airborne dust/PM10 and VOC)] . Exposure calculations were performed for adults, juniors, older children and children based on measurements of VOC, airborne dust, concentrations of chemicals in recycled rubber granulate and leaching from the granulate.

On the basis of estimated exposure values and the doses/concentrations which can cause harmful effects in humans or in animal experiments, it is concluded that the use of artificial turf halls does not cause any elevated health risk. This applies to children, older children, juniors and adults. The estimated Margins of Safety (MOS) also give no cause for concern.

As regards total VOC, higher values were measured than are normally found in homes. Values of up to 200-400 $\mu\text{g}/\text{m}^3$ fall within the normal range for housing. It is concluded that the values which were measured for total VOC do not constitute any elevated health risk but our knowledge of this area is rather inadequate. It is reasonable to assume that the relatively high VOC values could contribute to the hall air being perceived as "poor" without this in itself actually causing any elevated health risk.

As regards allergies, it is concluded that exposure to the low concentrations which were measured does not constitute any elevated risk with respect to the development of contact allergies. It is known that car tyres can contain relatively high concentrations of latex and therefore possibly also latex allergens. Latex is a potent airway allergen, but it would appear that latex in car rubber dust is either less available for uptake and/or deactivated. As no information is available concerning levels of latex in the rubber granulate that is used, it is not possible to assess the risk of developing an airway allergy. The possibility that the use of car tyres could cause exposure to latex allergens and thus lead to the development of airway allergies cannot be entirely eliminated. Studies have been carried out which indicate a link between exposure to phthalates and the development of asthma/allergies. At the present time, it is not possible to carry out a risk assessment in this area because of a lack of available knowledge.

Worst case calculations based on air measurements carried out by NILU and exposure values from the Norwegian Institute of Public Health indicate that training in sports halls does not cause any increased risk of leukaemia as a result of benzene exposure or any elevated risk as a result of exposure to polycyclic aromatic hydrocarbons.

On the basis of the exposures which have been calculated in connection with the use of indoor halls with artificial turf in which recycled rubber granulate is used, there is no evidence to indicate that the use of such halls causes an elevated health risk. A reservation must however be issued as regards the development of asthma/airway allergies, where the knowledge that is currently available is limited. This particularly applies to exposure to latex allergens, as no information is available on the occurrence of latex allergens in hall air, yet such allergens have been demonstrated in car tyre rubber. It should also be noted that little or no toxicological information is available for many of the volatile organic compounds which have been demonstrated as being present in the air in the halls. The concentrations of most substances for which insufficient information is available concerning harmful effects are extremely low and for this reason they are not expected to cause any increased health risk. However, not all organic compounds in the hall air have been identified. It is concluded that the exposure quantities which have been calculated for benzene and PAHs do not represent a cancer risk.

On the basis of the knowledge that is currently available concerning health effects and exposure linked to the use of indoor artificial turf pitches, we do not see any necessity to replace the recycled granulate at the present time. Due to a lack of knowledge as regards the possible induction of latex rubber, we recommend that recycled rubber granulate should not be used when rubber granulate is supplemented/replaced.

An environmental risk assessment of artificial turf for sport grounds have been performed, based on an investigation of content and leaking potential of hazardous substances in the material used. It was found that recycled rubber was the major source of potentially hazardous substances. An exposure scenario where the runoff from a football field is drained to a small creek showed a positive risk of toxic effects on biota in the water phase and in the sediment. The risk was mainly attributed to zinc, but also for octylphenol the predicted environmental concentrations exceeded the no environmental effect concentration. The total annual amounts of hazardous substances leaching from a normal sports ground are fairly low which means that any environmental effects are expected to be local only.

Dr. Christine Björge

Some key notes on Dr. Björge's occupation:

She works as a scientist at the Norwegian Institute of Public Health, Division of Environmental Medicine, Department of Chemical Toxicology.

Her research work is mainly related to reproductive toxicity, however, she is also involved in work related to human health risk assessment of chemicals under the Chemical Program in EU. This work includes writing and commenting on risk assessment reports of chemicals in EU and classification and labelling of chemicals in EU. Due to her knowledge of human risk assessment of chemicals she was involved in the work of the risk assessment for football players related to the use of artificial turf pitches.

