PE15) Necessity of effective doses, guidelines and regulations for health risk assessment on harmful algal blooms (HABs)'s toxins in water or food

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1. Introduction

Harmful algal blooms (HABs) are found in lakes, ponds, rivers and brackish waters throughout the world. In case of excessive growth such as bloom formation, these can produce inherent toxins in quantities causing toxicity in mammals including humans. This reviews the actual risky exposure scenarios, provides toxicologically derived reference values, suggests guidelines and performance standards, and discusses open issues and research needs.

2. Main Issue

Several water or nitrogenous food reserve created by *cyanobacteria* spp. have the capability to produce toxic compounds. These include cyclic peptides and alkaloids. Among the cyclic peptides are the cyanotoxins, the microcystins and the nodularins. The alkaloids include anatoxin, cylindrospermopsin, saxitoxins, aplysiatoxins and lyngbyatoxin. Both biological and chemical methods are used to determine cyanotoxins but other toxic compounds have not been yet. Health risk assessment for acute exposure could be relevant for some toxins of exposure. Nevertheless, no acute reference doses have formally been derived thus far. Official regulations for other cyanotoxins have not been established, although some provisional guideline values have been derived for microcystins in drinking water by the World Health Organization's (WHO) and several countries. A number of countries have developed regulations or guidelines for cyanotoxins and cyanobacteria in drinking water, and in some cases in water used for recreational activity and agriculture. Many international guidelines have taken their lead from the WHO's provisional guideline of 1.0 μg/L for microcystin-LR in drinking-water released in 2004. However, additional research is required to support guideline development, including whole-of-life animal studies with each of the known cyanotoxins.

Table 1. Major toxins produced by cyanobacteria and analytical methods

Categories	Name	Class	Number of forms	Splitters
Hepatotoxins	Microcystins	peptide	>85 known	HPLC-PDA
	Nodularins	peptide	>6	
Neurotoxins	Anatoxin-a	alkaloid	2-4	HPLC-FD LCMS
	Anatoxin-a(S)	alkaloid	1	
	Saxitoxins	alkaloid	26	
Cytotoxins	Cylindrospermopsin	alkaloid	4	HPLC-PDA
Dermatoxins	Aplysiatoxins & Lyngbyatoxins	polyether alkaloids	80	HPLC-FD LCMS
Neurodegenerative	β-methyl amino alanine		1	HPLC-FD

3. Conclusions

There is insufficient information available in a range of the categories usually required to satisfy comprehensive risk assessment process for the major toxins to currently adopt any of the international guidelines as regulations in the world. The major limitations that need to be overcome include: the capacity to deal with multiple toxin congeners, the absence of robust analytical methods for compliance monitoring, and the absence of certified toxin standards to support analyses.

4. References

Harada, K., 2004, Production of secondary metabolites by freshwater cyanobacteria, Chemical & Pharmaceutical Bulletin, 52, 889-899.

Watson et al., 2006, Naturally produced noxious chemicals and toxins in the Great Lakes, State of the Lake Ecosystem (SOLEC) 2006, Milwaukee WI, November, 1-3.