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Neurotoxicity of aluminum hydroxyl polymer on primary cultured neurons of rat cerebral cortex

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Abstract:

Aluminum(Al) is the 3rd most abundant on the earth. However, it is not essential and harmful to life beings. Al has been suspected to have a relation with various neurodegenerative diseases. The increased concentration of Al in the soil is implicated in the death of plants or fishes caused by acid rain. The toxic effects of Al are largely influenced by its chemical speciation; the concentration and the type of ligands coexist. Polynuclear hydroxy-aluminum complexes such as aluminum tridecamer(Al₁₃; [AlO₄Al₁₂(OH)₂₄(H₂O)₁₂]⁷⁺) is formed in the water under partially neutralization, and is more toxic in the growth of plant roots compared to monomeric Al³⁺ ion. In this study, we investigated the formation and the stability of Al₁₃ using ²⁷Al-NMR and developed a pulse-exposure method to apply chemically-identified Al₁₃ to primary cultured neurons of rat cerebral cortex. After 14 days of the exposure at 1 h, Al₁₃-intoxicated neurons exhibited significant decrease in cell viability. Meanwhile, monomeric Al³⁺ did not cause significant cell death. Our results will aid for the understanding the molecular mechanism of Al neurotoxicity.

Key words: chemical speciation; culture; Alzheimer's disease, acid rain

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