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# Fate of prions in soil : Interaction of prion proteins with soil surfaces and environmental consequences.

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Prions, the infectious agents thought to be responsible for Transmissible Spongiform Encephalopathies may contaminate soils and have been reported to persist there for years. Thus, assessment of dissemination risk requires an understanding of the mechanisms of interaction between prion proteins and soil solid surfaces. Ovine $PrP_{rec}$ ($\alpha$ or $\beta$ structured) was used as a model of the prion entity. Montmorillonite, mica and amorphous silica were chosen as models of soil surfaces.

The structure of the adsorbed protein was examined by FTIR spectroscopy [1]. The organisation of the protein layer was determined by NMR spectroscopy. The $PrP_{rec}$ adsorbed amount was quantified by NMR, FTIR, radiolabeling ($^{125}I$) and depletion approaches (Western blot, ELISA). Desorption was explored in stationary or laminar flow conditions [2].

An important observation was the correlation between the $PrP_{rec}$ structural changes and the irreversibility of adsorption. Two types of interaction were identified:

(i) With montmorillonite, $\alpha$ to $\beta$ conversion occurred. Very stringent conditions (extreme pH, detergents, high ionic strength) did not achieve desorption and competition with other proteins (animal serum) did not alter the level of $PrP_{rec}$ adsorption, either on montmorillonite or mica. Comparison between full length and N-truncated protein behaviour, suggested combined hydrophobic and electrostatic effects associated with the N-terminal part.

(ii) On amorphous silica, no structural conversion occurred and the adsorption was

completely reversible.

An electroelution process was devised allowing efficient removal of $PrP_{rec}$ from montmorillonite and applicable to crude soil samples [3]. It might open the way to quantitative and sensitive detection of prions in soil.

As a whole, this study leads to novel information on $PrP_{rec}$ structure in contact with surfaces, opens practical tracks for decontamination and gives indication on possible mode of dissemination of prions in soils and waters.

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[2] Vasina E.N., Déjardin P., Rezaei H., Grosclaude J. & Quiquampoix H. (2005). Fate of prions in soil : Adsorption kinetics of recombinant unglycosylated ovine prion protein onto mica in laminar flow and subsequent desorption. *Biomacromolecules*, 6, 3425-3432.

[3] Rigou P., Rezaei H., Grosclaude J., Staunton S. & Quiquampoix H. (2006) Fate of prions in soil : Adsorption and extraction by electroelution of recombinant ovine prion protein from montmorillonite and natural soils. *Environmental Science and Technology*. In press.

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