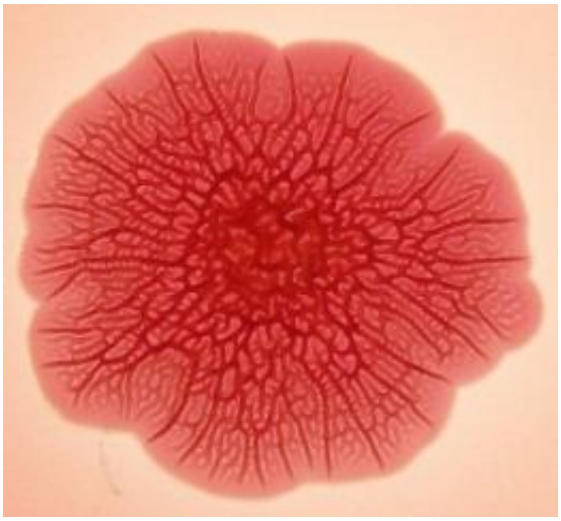
Why is it so difficult to eradicate salmonella?

February 2 2010



Salmonella forming a biofilm on an agar plate. Photo: Nesse & Vestby, National Veterinary Institute

Feed contaminated by salmonella bacteria is a familiar and costly problem for the animal feed industry all over the world. Some types of salmonella have succeeded in establishing themselves in feed and fish meal factories and have persisted there for several years because it has proved impossible to eradicate them.

In her doctoral thesis, Lene Karine Vestby therefore studied why it is so difficult to get rid of salmonella once they have managed to establish themselves in Norwegian feed and fish meal factories. She discovered that salmonella bacteria efficient at forming biofilm (bacteria coating) survived for longer in the factories than those that had a reduced ability

to form this coating. The ability to survive in factories therefore appears to be connected with the ability to form a biofilm and it would seem that removing biofilm is a necessary step towards eradicating salmonella from the factories.

In a biofilm, bacteria are well protected by a slime (matrix) which they produce themselves. Vestby has studied the effect of the nine most frequently used disinfectants in the Norwegian animal feed industry and found that the efficiency of the disinfectants is substantially reduced if the salmonella has managed to form a biofilm. The effect of the majority of the disinfectants was then no longer satisfactory, but a product containing 70% ethanol was the most efficient, followed by one called Virkon S.

Cooperative behaviour between bacteria (quorum sensing) is an important factor in the ability to form biofilm. In recent years, so-called furanones have been developed, which are known to inhibit quorum sensing and thereby also the formation and maturation of biofilm. Vestby has shown that a furanone can be a useful tool in the fight against salmonella in factories. The furanone prevented the salmonella bacteria from forming an adequate biofilm and the bacteria were therefore more vulnerable to disinfectants, with the result that the disinfectants worked better.

The matrix produced by the salmonella bacteria in the biofilm consists of many different components, one of which is cellulose. A surprisingly large proportion of salmonella found in Norwegian feed and fish meal factories appeared not to produce cellulose. It has been claimed that cellulose is important for protecting bacteria in a biofilm, but Vestby's laboratory tests have demonstrated that biofilm with or without cellulose respectively afforded the bacteria the same protection against disinfectants. On the other hand, it appeared that cellulose in the biofilm gave the bacteria better protection against dehydration over a period of

several months.

MSc Lene Karine Vestby presented her doctoral thesis on 5th November 2009 at The Norwegian School of Veterinary Science. The thesis is entitled: "Biofilm formation by Salmonella from the Norwegian feed industry - with attention to potential persistence and eradication."

Provided by Norwegian School of Veterinary Science