

Inactivation of the BSE agent

David Taylor*

SEDECON 2000, 147 Oxfangs Road North, Edinburgh EH13 9DX, UK

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Abstract – In the studies carried out so far, the BSE agent has proved to be just as resistant as other TSE agents to inactivation by procedures such as autoclaving or exposure to sodium hydroxide that are effective with conventional microorganisms. However, in common with other TSE agents, the BSE agent appears to be effectively inactivated by exposure to sodium hypochlorite solutions containing high levels of available chlorine. Not surprisingly, the BSE agent has been found to survive at least some of the rendering processes that were used to process tissues discarded by abattoirs in the EU during the early 1980s. Despite the survival of BSE infectivity after autoclaving or exposure to sodium hydroxide, it is known that combining these procedures results in a very reliable degree of inactivation for TSE agents generally. The combination of heat and alkali has also been shown to be effective with a mouse-passaged strain of BSE agent, even at a temperature of only 100 °C for a minute. Also, in carrying out BSE-spiked validation studies relating to the safety of bone-derived gelatin, it has also been found that the exposure of acid-treated bone (which is free from any obvious remains of fatty or proteinaceous tissue) to 0.3 M sodium hydroxide for two hours knocks out any residual BSE infectivity. To cite this article: D. Taylor, C. R. Biologies 325 (2002) 75–76. © 2002 Académie des Sciences/Éditions scientifiques et médicales Elsevier SAS

BSE agent / inactivation / autoclaving / sodium hydroxide / sodium hypochlorite / rendering / gelatin production

1. Introduction

The unconventional agents that cause transmissible spongiform encephalopathies (TSEs) such as Creutzfeldt-Jakob disease (CJD) in humans and scrapie in sheep are known to be relatively resistant to a wide range of decontamination procedures including exposure to autoclaving or sodium hydroxide [1]. Bovine spongiform encephalopathy (BSE) was first reported in the mid 1980s, and is the latest animal disease to have joined the TSEs. Experimental studies have confirmed that the BSE agent, like other TSE agents, is relatively resistant to inactivation by exposure to autoclaving or sodium hydroxide [2], and this implies that it is also likely to be resistant to the wider range of decontamination procedures that have been shown to be ineffective with other TSE agents [1]. The BSE agent does, however, appear to be inactivated by exposure to

sodium hypochlorite solutions containing high levels of available chlorine [2], and this accords with the earlier experience using mouse-passaged strains of scrapie agent [3].

2. The vCJD agent

There is compelling evidence that the variant (v) form of CJD first reported in the UK in 1996 [4] is caused by the BSE agent [5]. Studies that are in progress to determine whether or not the vCJD agent is also relatively resistant to inactivation have not yet yielded any results. However, it seems unlikely that the vCJD agent will prove to be significantly different from other TSE agents in this respect.

*Correspondence and reprints.

E-mail address: david.taylor@sedecon2000.freemove.co.uk (D. Taylor).

3. The agents studied

The BSE-related inactivation studies referred to above were carried out using infected bovine brain-tissue. Further studies have been carried out using brain-tissue from mice infected with the 301V strain of BSE agent that was derived from the serial passage of the BSE agent in VM mice. 301V has been shown to be the most thermostable strain of TSE agent identified so far [6]. It is not completely inactivated by autoclaving at 138 °C for 1 h [7], and partially survives exposure to hot air at 200 °C for 1 h [8].

4. Inactivation with hot alkaline solutions

Despite the failure of autoclaving or sodium hydroxide exposure to reliably inactivate TSE agents, it is known that inactivation can be achieved by combining these processes [7]. The use of hot alkaline solutions has even been shown to be effective when 301V is simply boiled for 1 min in 1 M sodium hydroxide [9].

There is considerable interest in the applicability of the hot alkaline process to problems as diverse as the decontamination of specified risk materials obtained from abattoirs, and its potential to reliably inactivate CJD infectivity that could be unwittingly present on surgical instruments after their use on patients that are in the preclinical, asymptomatic phase of the disease.

5. BSE infectivity

In addition to the experiments described above, validation studies have been carried out with regard to

the BSE agent to determine the degree of inactivation achieved by the rendering processes that had been used traditionally within the EU [10]. These showed that, in the worst-case scenario, there was almost as much infectivity in the meat and bone meal as there was in the untreated, BSE-spiked raw materials. However, infectivity was not detected in the unfiltered tallow obtained from the same process. This indicates that BSE infectivity does not have a predilection to migrate into tallow during rendering, as has been suggested [11].

6. BSE infectivity in gelatin production

It is widely known that the gelatin manufacturers of Europe are currently carrying out validation studies to address the question as to whether gelatin derived from bovine bones is completely safe for consumption by, or injection into, animals or humans. These have already provided data indicating that the degree of inactivation or removal of infectivity achieved by the traditional acid or alkali processes is sufficient to provide such a reassurance, quite apart from the added confidence arising from the required exclusion of high-risk material from the manufacturing processes. These studies have also shown that the introduction of a step involving a 2-h exposure of acid-treated bone to 0.3 M sodium hydroxide appears to completely eliminate any residual BSE infectivity. [12] If there were to be any lingering doubts regarding the safety of gelatin, manufacturers could incorporate this brief sodium hydroxide treatment into their production processes to provide a higher degree of reassurance. This treatment would be equally applicable to the alkali extraction system because, in its first stages, it involves exposure to the same conditions that are applied during the acid extraction process.

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