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Development of Safety Squid Anesthesia using the Byproducts of Salt Manufacturing

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Summary

In 2022, the catch of squid in Japan decreased by 93.7% compared to the peak year of 1968. Noto Town in Ishikawa Prefecture, Japan is one of the largest squid catch areas in Japan, following Hakodate City in Hokkaido, Japan and Hachinohe City in Aomori Prefecture, Japan. However, in recent years, the stock of squid in the Yamato Bank, a good fishing ground for squid in the territorial sea off Noto Town, has been drastically reduced due to illegal operations by foreign-registered vessels using fish-collecting lights with such high illumination that they can be seen from space. The drastic decrease in squid stocks has led to the depopulation of Noto Town, which has become a potentially vanishing city. The principal researchers are therefore attempting to develop a locally produced and consumed live squid transport technology that can achieve high value even with small catch, in order to contribute to Noto's fisheries industry and the creation of a SATOUMI. However, squid are difficult to rear because they spit ink under stress and the rising ammonia etc. caused by the ink deteriorates the water quality. Furthermore, live squid transport is generally done in individual packages because of fighting, and high-density transport is not possible. In this study, a specific anaesthetic for squid was developed and high-density transport of live squid under anaesthesia was attempted.

The experiments used bigfin reef squid (Sepioteuthis lessoniana) and spear squid (Heterololigo bleekeri) caught in Noto Town, Ishikawa Prefecture, Japan. These squids were acclimatised for several days in UV-sterilised filtered seawater from the Noto center for fisheries science and technology, Kanazawa university. Recently, we found that squid immersed in 6% Japan Sea proper water salt by-product 'bittern' (hereafter referred to as 'bittern') became anaesthetised after spitting ink. Therefore, we measured the convulsions, ink vomiting and anaesthesia time of squid immersed in seawater with various concentrations of 'bittern'. Squid were also placed in seawater containing various concentrations of components other than magnesium in 'bittern' to elucidate the component of 'bittern' that induces convulsions and vomiting of ink, and to investigate the duration of action.

The bigfin reef squid were placed in 1.0, 2.0, 2.5, 3.0, 4.0, 5.0 and 6.0% 'bittern' and became anaesthetised at 2.0% or more 'bittern'. All were awakened by the addition of seawater, but a few deaths were observed at 'bittern' 5.0% and above. Next, when spear squid were placed in 2.0, 2.5, 3.0, 4.0, 5.0 and 6.0% 'bittern', they became anaesthetised at 2.5% 'bittern' or higher. As with the bigfin reef squid, the squid was awakened by the addition of fresh seawater, but there were several deaths at 'bittern' 5.0% and above. The pH of the anaesthetic solution with

'bittern' and each squid was around pH 8.4, similar to natural seawater, and the dissolved oxygen was concentration-dependently close to 10 mg/L of natural seawater. This indicated that higher concentrations and shorter anaesthesia times resulted in lower dissolved oxygen consumption. As a result, it was estimated that "bittern" of between 2.0% and 6.0% is good for anaesthetising bigfin reef squid and "bittern" of between 3.0% and 4.0% is good for anaesthetising spear squid. In the future, it will be examined whether anaesthesia can be applied under these conditions and whether high-density rearing is possible.