# 'Teabags' keep divers warm



How's the water? Freezing cold!

For a breathtaking experience try swimming in the icy waters of the Antarctic. The ice is brilliantly white, the water penetratingly blue and clear, and the temperature below freezing.

Scuba divers involved in the Antarctic Division's biological program are finding out remarkable things about the marine life of this pristine environment. With their cameras and sampling gear, they dive and swim freely beneath the ice to explore a world that only recently has been revealed to human eyes.

Entering an under-water environment where the temperature is typically $-3°C$ requires the help of modern technology. Some American scientists swaddle themselves in 'dry-suits' that, by an elaborate (and expensive) combination of zips and seals, keep the diver dry. By building up layers of insulating clothing beneath the suit, the intrepid explorer can also keep warm.

The Australian preference is for wet-suits. These are cheaper and less cumbersome; more importantly, any damage to them can be easily repaired in the field. Although the experience of having freezing water trickling into your wet-suit cannot be called pleasant, the water soon warms, and further loss of body heat is slowed down by 6–10 mm of neoprene. Dives typically last about 30 minutes before shivering and numbness force the diver to the surface.

Heat-releasing 'teabags' are now improving the diver's lot, making him more comfortable and extending the time he can stay under water. They are the idea of Mr Des Burton and Mr Colin Chan, of the CSIRO Division of Energy Technology. The special sachets are placed in pockets sewn into a vest worn beneath the wet-suit. This gives warmth to the torso, and bags placed inside gloves provide heat to the hands.

The sachets look like teabags, with their active ingredients sandwiched between wet-strength paper (dish cloth, in fact). And, like their look-alike, they can be conveniently stored until their meeting with water. Similarly, after they have performed their function, they are discarded.

Unlike teabags, these when dunked release 1–10 watts of heat for an hour or more. The Antarctic Division has been using the sachets for the last two diving seasons, although Mr Burton had in mind a less-specialized usage originally. He still reckons that many scuba divers, and even winter surf-board riders, would find them useful, and he hopes somebody will want to make them commercially.

Mr Burton and his colleagues, with true determination, spent many hours in the Division's chilled water tank perfecting the sachets. The bags contain a 10-g mixture of magnesium and iron turnings. These metals react with sea-water, the system behaving like a collection of short-circuited batteries. The magnesium is consumed, giving out heat in the process.

In the optimum configuration, heat flows most strongly for 30–60 minutes, tapering off after that. The particle size, amount of iron, and packing density need to be balanced so that the reaction doesn't proceed too quickly or too slowly.

The number of teabags employed varies according to the temperature of the water, the activity of the diver, and how long he wants to stay under water. One or two dozen is a typical number, the latter providing up to 50 W of heating.

Mr Burton notes that this level of heating won't keep the diver warm; it will only slow down the rate of cooling of the body. Although it provides but a quarter of the long-term needs, tests in the chilled water tank have shown that this is enough to double the time that elapses before the hapless test subject, shivering and miserable, is compelled to emerge.

That's because cold causes the body to cut down on blood circulation to the skin surface, reducing heat loss. Even just restricting the bags to within gloves can postpone the first sign of cold — numb fingers — and so extend the duration and usefulness of a dive.

*Andrew Bell*

One of the 'teabags'.