Going down

Think you can dissolve a body in an acid bath, *Breaking Bad* style, and get away with it? Think again, says **Erwin Vermeij**

WORKING at the Netherlands Forensic Institute, almost nothing comes as a surprise. In the past 15 years I have seen more than most people could imagine, including a victim who was chopped up and stir-fried and another whose corpse had been fed through a wood-shredder. But 12 years ago, I was stumped when police unearthed a large, moist, off-white block in the garden of a suspected drugs trafficker.

My first thought was to have it tested for cocaine and heroin. The results revealed something quite unexpected: it was gypsum. This was no ordinary lump of plaster, though; when I broke off some pieces from the

LANE CODER/GALLERYSTOCK

5-kilogram block, I noticed unusual pink and brown dots. Under the microscope, they were made up of sand and strange, irregularly shaped, thin-walled structures, which turned out to contain calcium, phosphorus and fluorine. When we find calcium and phosphorus in a forensic investigation, alarm bells start ringing because bone contains these minerals. But fluorine?

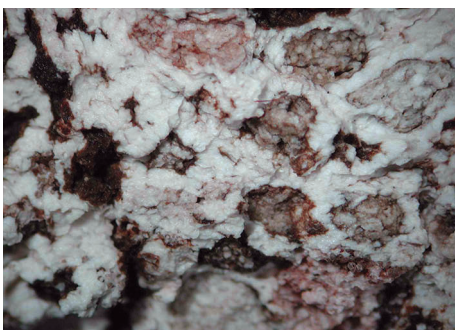
At around the same time, a witness told police that the suspect had killed his associate and then burned him in an improvised incinerator. There was no trace of either the victim or the incinerator, but the presence of fluorine gave me an idea: perhaps the killer had tried to dissolve the cremated corpse in hydrofluoric acid and then mixed the residue with gypsum plaster. Could these peculiar thin-walled structures be all that remained of the bones?

The scenario will sound familiar to anyone who watched US drama *Breaking Bad* where, in an early episode, an inconvenient corpse was dissolved in hydrofluoric acid – along with the metal bath in which it was placed, resulting in the liquefied remains eating through the ceiling, which collapsed into the room below. Such blunders aside, dissolving a body in acid might seem like the ultimate disposal method. But that was fiction. In reality, acid may not be such a quick and simple solution to a dirty problem.

Body of evidence

Perhaps the most notorious acid bath murderer was the English serial killer, John Haigh, who was convicted of murdering six people in the 1940s. He used concentrated sulphuric acid to destroy their remains, but sifting through the greasy soil at his workshop police still found 13 kilograms of human body fat, three faceted gallstones, part of a left foot, 18 fragments of human bone and intact upper and lower dentures. Haigh had reduced the sum parts of his victims, but they were far from vanished without trace. Enough evidence remained to see him hanged.

But what if Haigh had simply used the wrong acid, or went about it in the wrong way? Perhaps acid would be more effective if it was used to dissolve cremated bone. Since this was the first potential acid bath murder I had come across, I had no experience to draw on. Nor could I find anything in the scientific literature about the efficacy of acid as a



NFI

Incriminating remains: these microscopic thin-walled structures tell a gruesome story

disposal method. So I began conducting some experiments of my own.

Acids come in two varieties, "strong" and "weak", and both can be made into a concentrated or dilute solution depending on how much water is added. All acids lose hydrogen ions when in solution, but strong acids, such as hydrochloric acid, are more corrosive because they completely ionise, whereas weak ones, like acetic acid, only partially ionise. Dissolving bodies relies on water reacting with proteins and fats, which break down into a slurry of amino and fatty acids. Acids catalyse this hydrolysis, and the more ions are available in solution, the faster it can happen. Meanwhile, acid also catalyses the degradation of the hydroxyapatite in bones into a solution of calcium and phosphate.

In theory, any acid will do. In practice, my investigations revealed that some, including hydrofluoric acid, are too weak to break down the proteins and fat in soft tissue. Indeed, a recent episode of *MythBusters*, the *Breaking Bad Special,* confirmed this finding. Stronger acids, such as hydrochloric acid and nitric acid, work better. Nitric acid is not only a strong acid, it is also a powerful oxidiser, able to break down fat and protein to carbon dioxide and water so that eventually they dissolve without trace.

However, the use of strong acids isn't without risk. The reactions release heat, and if the temperature rises above 100 °C the mixture will start to boil, generating extremely corrosive toxic fumes. With nitric acid, there is also the risk that highly explosive compounds such as nitroglycerine – the main constituent of dynamite – will form.

Even if strong acids are used, dissolving a corpse is a lengthy process, as pathologist Massimo Grillo at the University of Palermo in Italy found. At the 2011 annual meeting of the American Academy of Forensic Science, he reported experiments in which his team tried to substantiate claims that the Mafia hitman Filippo Marchese could dissolve a human body in just a few minutes using sulphuric acid. Instead, they found it took weeks. Even then, they concluded, something is likely to remain – whether it be gallstones or artificial components such as implants and false teeth.

But what would happen if the protein, fat and much of the bone structure had already been destroyed by fire? Back in our lab, we exposed cremated human bone to mixtures of hydrofluoric and nitric acid; the suspect was a welder so would have had access to this combination of acids in the form of pickling acid used to treat steel. Sure enough, we were able to reproduce the odd thin-walled structures we had seen encased in gypsum. The more diluted the acids, the more delicate these arrangements were. This is because they are the residues of incomplete hydrolysis and dilute acids contain more water to keep the process going for longer.

Dead giveaway

This was enough to see our suspect convicted and sentenced to 18 years in jail. But the story doesn't end there. Recently, police sent me the stinky contents of a drain from a house in Belgium in which, a witness had told them, two men had been digested in acid and tipped down the drain. Once again, we found several thin-walled structures. This time we knew what they signified. The killers – a mother and one of her sons – were sentenced to 15 and 13 years respectively. Another son and the "witness" were given 27 and 30 months for their part in disposing of the evidence.

It seems that *Breaking Bad* may have revived a grim interest in using acid to dispose of incriminating corpses. With the right acid this method is pretty effective – but it is far from perfect. Something will always be left behind. And there's another reason why any would-be John Haigh should pause for thought. As these cases reveal, the horror of dissolving a body is often too great a secret to keep to oneself. You, or your collaborators, may feel compelled to confess. And when you do, we now know just what to look for. ■

Erwin Vermeij is a forensic scientist with the Netherlands Forensic Institute in The Hague