Representing Alkaline Hydrolysis: A Material-Semiotic Analysis of an Alternative to Burial and Cremation

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Abstract

Alkaline hydrolysis can lay claim to being a resource-efficient, effective, economical and environmentally sound method of final body disposition, relative to burial and cremation. On technical grounds it may have much to recommend it, however, like many other technical innovations, its take-up is hindered by the fact that it lacks a clear position in the public imagination. For this position to take shape, an understanding of just what it is and what it offers is required by proponents in the funeral industry who advise the bereaved, as well as by the material representations of the alkaline hydrolysis technologies themselves. In this article, we describe and analyse four extant alternative material and discursive forms of alkaline hydrolysis and how they variously occupy the fraught space where morality, death and marketing converge. Currently, each of the four forms of alkaline hydrolysis struggle to represent themselves in a public narrative that conveys their different ontologies and their competitive advantage, relative to burial and cremation, and this paper describes some key rhetorical and technical aspects of these struggles.

Keywords: alkaline hydrolysis; cremation; material semiotics; body disposal; death care industry.

Forward

On December 26, 2021, Archbishop Desmond Tutu died at age 90. In a surprise for many, the internationally renowned Nobel Prize laureate and anti-apartheid activist chose alkaline hydrolysis for the final disposition of his body. Surprising though this may have been, to have such a well-known and well-loved figure make such a choice would have delighted those who provide alkaline hydrolysis equipment and services, for

the method lacks widespread support among funeral professionals and has not yet found a substantial market. Illustrating this, in the October 1, 2021 edition of "Connecting Directors", a breezy online publication with a readership in the US funeral industry, Eli Gable writes, under the heading 'Alkaline Hydrolysis must be stopped':

> Alkaline what?
>
> Call it what you want, aqua-cremation, water-cremation, or… alkaline hydrolysis. No matter how you label it, it's off-putting. Now, I have zero objections to providing an alternative to traditional cremation. Competition, innovation- I love that stuff! BUT, branding is a very important thing, and honestly, the funeral profession could use a lot of it.
>
> So, here are my alternatives to "alkaline hydrolysis."
>
> 1) Splish Splash, Splish Splash, There You Go Now You're Ash
>
> Yes, it's a mouthful, but it is memorable and it doesn't sound threatening. Alkaline hydrolysis sounds like a science experiment. SSSSTYGNYA sounds approachable and fun.
>
> 2) Super Soaking
>
> "I understand Hermin wanted to be super soaked after his funeral." -You (if you adopt this terminology."
>
> No explanation is needed. This is gold.
>
> 3) MOAB- Mother of all Baths
>
> After this scrub-a-dub, there'll be no more need to scrub-a-dub. (Gable, 2021)

If this is an indication of the funeral profession's attitude to alkaline hydrolysis, it clearly has further work to do if it is to find a substantial place as an alternative to burial or cremation in the public imaginary.

Introduction - Alkaline Hydrolysis and the Final Disposition of the Body

Alkaline hydrolysis, a process in which the complex molecules that make up organic material are chemically broken down, is arguably an economical and environmentally preferable method of final disposition, relative to burial and cremation (Health Council of the Netherlands, 2020). As a technology for the final disposition of the human body, alkaline hydrolysis has the potential to take a significant share of the market away from burial and cremation. However, its take-up has been hampered by a lack of awareness and understanding of the technology in the public imagination. Much of this lacuna can be attributed to the industry and its traditional and often conservative models of operation and marketing. A public understanding of alternatives requires proponents in the funeral industry who advise the bereaved to participate in messaging (van Ryn et al. 2018), alongside the material representations of the technologies themselves.

In the markets sought by alkaline hydrolysis, deathcare products and services are primarily managed by funeral directors, and cemetery and funeral home staff in an industry historically resistant to change (Arnold et al, 2018; McIlwan, 2005) These professions are generally the first point of contact for members of the public seeking to find and purchase items for commemoration, and they play a critical gatekeeper function (van Ryn et al. 2018). Innovations also need to address the marketing challenges of the deathcare industries and their struggle to maintain a balance between genuine concern for the bereaved and commercial opportunism (Emke, 2007; Mitford, 1963; Sanders, 2012).

To attract customers to their products and options, ‘traditional’ death care providers have developed a strong moral discourse around the work that they do. In Sanders’ influential accounts (2009; 2012), people in the funeral industry are positioned

as moral entrepreneurs working to preserve an important social benefit. Sanders' research homes in on consumption more generally (2009), to show how the modern funeral industry in America has responded to (and encouraged) personal service through providing for expressions of individualism. New technologies, such as alkaline hydrolysis, may potentially play a key role in this process. By adopting technological innovation within their suite of products and services, funeral directors are able to demonstrate flexible and personal care by enabling consumers to engage in this increasing co-production and personalisation of funerals (Sanders, 2012, p. 266). Burial caskets and urns can be customised to better represent the personality of the deceased; off-the-shelf coffins are sold in a huge range of styles and materials; ashes can be blasted off into space or incorporated into jewellery for family and friends to wear (Sanders, 2009). Nevertheless, whilst the range of products and services offered within the funeral industry is diverse and growing (Arnold et al, 2018, pp. 98-124), a persistent problem remains: promoting products associated with death remains a fundamentally difficult endeavour in the context of the typical customer's inexperience, longstanding distrust of commercial for-profit activity surrounding death, a reluctance of people to consider death products and services "pre-need", and the perennial ethical issue of marketing products and services to the bereaved.

A potentially important innovation in the provision of deathcare services is the use of alkaline hydrolysis for the final disposition of the body. In this article four alternative forms of alkaline hydrolysis are analysed through their material operations and discursive representations, drawing on fieldwork in the funeral and cemetery industries and applying a material-semiotic approach[1]. The analysis is of four case studies of

[1] The research was approved by the University of Melbourne Human Ethics Advisory Group , Ethics ID 1954540.1

extant products and representations, each of which is in commercial operation in the US and/or Australia and Canada, examining their narratives, their associated materiality and symbolism, and their imaginaries and myths. Our analytic approach explores how these forms variously occupy the fraught space where morality, death and marketing converge.

The form that is branded "Resomation" and is based in the UK is most straightforwardly aligned with cremation, both through the materiality of its retort[2], which is built to resemble a cremator, and through the use of the term "water cremation" to describe its function. The form branded "Bio-Response Solutions" announces itself as an innovative and high-tech 'family owned' service based out of Indiana in the US. Materially, the retort is cylindrical, diagonally inclined and festooned with visible input and output pipes and vents. Discursively, it is promoted in terms that emphasise its technical superiority to cremation. Conversely, the form branded and trademarked as "Aquamation", and "proudly based in Australia" is presented as a less "industrial" alternative to cremation, both through the appearance of its retort, which resembles a casket, and through its marketing materials, which focus on the harmful environmental effects of cremation that Aquamation avoids. The final and newest form of alkaline hydrolysis branded "Qico" and based in Southern California, takes an entirely different semiotic strategy by appealing directly to the end customer with a promise of an aesthetically and emotionally satisfying experience. This is apparent in the form of its retort, which is organically curved and sculptural.

Currently, all four forms of alkaline hydrolysis struggle to name and describe the technology in a manner that resonates with a wide public or global marketplace, and

[2] The retort is the container in which the body is processed.

struggle to represent it in a narrative that conveys its material, symbolic, or competitive advantage. To varying degrees, all four companies position their products in an environmental narrative and appeal to a widespread desire and consumer sensibility to be environmentally responsible. The companies might be largely unknown, and their products might be largely unknown, but the problem they claim to address is very well known. Nevertheless, it appears they each come up against a wall of resistance in their efforts to create a clear, coherent and fully attractive representation of alkaline hydrolysis, for the industry, consumers, or the public. Before we consider these different material and discursive forms of alkaline hydrolysis in more detail, we describe more generally what this 'necro-technology' entails, and how it has come to be seen as an alternative to cremation.

Background

A Technological Alternative to Cremation

Chemists have little trouble clearly representing alkaline hydrolysis and do so frequently in textbooks and technical papers. For the chemist, alkaline hydrolysis is an ion-exchange chemical process that occurs in nature, particularly in moist soil and in the digestive systems of mammals, where temperatures are above zero and pH is neutral or alkaline (Kaye et al., 1998, 2004). But when used to describe a process for the disposal of human remains, in a world far away from the chemistry lab but close to death, commemoration and grief, alkaline hydrolysis struggles to be understood.

The chemistry of alkaline hydrolysis forms the foundation of the environmental credentials claimed for the process, and for the claims that it is a 'gentler' form of final disposition than cremation. Alkaline hydrolysis is a chemical process in which the complex molecules that make up organic material are broken down into their

constituent building blocks, as ions of water, Hydrogen ions and Hydroxide, insert themselves between the atoms of the bonds that held those complex molecules together. This naturally occurring process can be considerably speeded up by immersing the organic material in question in water, increasing alkalinity to a pH ~14 through the addition of Sodium Hydroxide and/or Potassium Hydroxide, increasing temperature to ~ 95C @ atmospheric pressure or ~ 150C @ 65psi, and then agitating the solution (Kaye et al., 1998, 2004). In this process, all protein-based biological material is reduced to its component chemicals. All proteins are destroyed. All cells and fats are destroyed. RNA is rapidly destroyed. DNA is slower but also breaks down to constituent chemicals. Prions are destroyed (Murphy et al 2009), along with all pathogens, viruses, bacteria and protein-based biological material (Kaye et al 1998). The process was taken from nature, artificially accelerated in the laboratory, and first patented by Amos Herbert Hobson in 1888 for the extraction of nitrogenous materials from animal bones to produce fertiliser and gelatine. Since the early 1990s, alkaline hydrolysis has been further developed to safely dispose of animal carcasses, laboratory animals, and hospital waste (Kaye et al., 1998). Various attempts to develop the technically proven technique for the death care industry, to offer an alternative mode for the disposition of human bodies, have taken place over the last 20 years.

In the context of treating human remains, the process of alkaline hydrolysis produces a green-brown liquid containing single amino acids or small peptides in the 2-5 residue range (98% of the liquid), some sugars and salts, and the mineral residue of bones (chiefly calcium phosphate), which the family can take away for memorial purposes (Powell, 2017; Stockton, 2017). The water residue is sterile and in the US is disposed of through standard waste-water systems once brought back to a neutral pH, though in the United Kingdom and Australia there have been difficulties obtaining

required waste-water effluent permits, arguably on the basis of cultural sensitivities rather than public health concerns (Fox, 2017). The water residue is also claimed to be a useful plant nutrient (Kang et al., 2019). Interestingly, cellulose-based organic materials such as cotton, polyester and linen are not broken down, but wool, leather, silk and other protein-based materials are, which has implications for dressing the body in preparation for alkaline hydrolysis.

As a technology, alkaline hydrolysis has the potential to take a significant share of the market for the final disposition of the human body away from burial and cremation. As a chemical technique, alkaline hydrolysis is scalable, in that like cremation, it can cope with increased demand by increasing the number of retorts to meet that demand – whereas acquiring sufficient land to meet demand for burial is very problematic in many parts of the world. It is cost-competitive in comparison with burial and cremation and is more affordable in some locations, although it is difficult to generalise about this as there are considerable local variations in the costs of all forms of disposition. Importantly, given the real and present dangers of the Anthropocene, there is evidence that the technique is environmentally benign compared to cremation, in that it does not require fossil fuels and does not emit greenhouse gases, and is still more environmentally benign in comparison to standard forms of burial (Keijzer and Kok, 2011; McClurg, 2017). Finally, for some members of the public, it may offer a more aesthetic and emotionally 'gentle' method of disposition in comparison to being burned, and this more 'gentle' approach is a point of contrast to cremation frequently made by alkaline hydrolysis providers.

Institutional Responses to Alkaline Hydrolysis

As illustrated by Connecting Directors' "Splish-Splash" story, alkaline hydrolysis has faced considerable resistance from stakeholders in the funeral industries, from consumers, from legislators and regulators, and from some religious groups. When legislators in Indiana—the location of Bio-Response Solutions' head office—moved to legalise alkaline hydrolysis in 2015, Indiana State Representative Richard Hamm[3] was reported to have responded incredulously: "We're going to put them in acid [*sic*] and just let them dissolve away and then we're going to let them run down the drain out into the sewers and whatever" (Cook, 2015). The move was defeated. In 2012, the Association of Independent Funeral Homes of Virginia lobbied for legislation (HB379) that would have criminalised the use of alkaline hydrolysis technologies in Virginia. Edwards Funeral Service in Columbus, Ohio, started offering alkaline hydrolysis in 2011. Owner Jeff Edwards dissolved 19 bodies before the Ohio Department of Health suddenly stopped granting permits for the process, and the Ohio Board of Embalmers and Funeral Directors accused him of "immoral or unprofessional conduct" (Olson, 2014). A messy legal battle left Edwards with $150,000 worth of equipment gathering dust and, to meet demand, he was forced to transport bodies across state lines to Chicago for the procedure.

These responses may be extreme, but they are consistent with an industry that is more conservative and subject to inertia than most (Arnold et al., 2018). This is important for alkaline hydrolysis, given the gate-keeping role played by funeral companies in determining the mode of final disposition. For the funeral company, considerable investment is required to buy alkaline hydrolysis retorts and further investment in infrastructure may be required in the form of buildings and plumbing.

[3] Hamm was also the owner of two casket manufacturing businesses: the Paul Casket Company and the Cambridge City Casket Company (Cook, 2015).

Given a choice between (1) making a significant capital investment and then offering alkaline hydrolysis to meet an uncertain demand, or (2) not making the investment, not offering a service that is largely unknown to the public anyway, and simply servicing existing demand for burial and cremation, the industry has thus far opted for (2).

Another source of inertia is that some major religious communities tend to mandate burial (such as Orthodox Jewish and Islamic) or cremation (such as Hindu) and would thus likely regard alkaline hydrolysis as unacceptable to the faithful. The long-standing Catholic position on the final disposition is to mandate burial in consecrated ground. As Mirkes suggests:

> The Catholic Church has sound theological reasons for its unswerving promotion of burial as the normative practice for bodily disposition. Burying the deceased highlights important truths. Just as faithful Catholics have shared in Christ's life, death, and burial, so, at the end of time, each of their bodies will be reunited with its soul to share in an eternal, resurrected life with the risen Lord (2008, p. 683)

Among some, this theological position has struck home and has produced an antipathy for cremation, perhaps aided by the association of fire with Hell. As a Director of Kings Funerals in Tremé, New Orleans remarked in conversation with the authors: "Our community is Christian, and some are good Christians and some aren't so good. The good ones don't want to burn, and the bad ones don't want to burn twice!".

However, in regard to alkaline hydrolysis, there are some Catholic theologians, such as Sr. Renée Mirkes, who argue that…

> […] if alkaline hydrolysis were chosen for good reasons (environmental, economic, financial, or psychological) and in a manner that comports with the

> resurrection of the body, it would be a moral means of final disposition (Mirkes, 2008, p. 691)

In 2011, the Catholic Conference of Ohio declared: "Dissolving bodies in a vat of chemicals and pouring the resultant liquid down the drain is not a respectful way to dispose of human remains" (McGough, 2013). In 2013, the California Catholic Conference urged the state's Senate to vote "no" on legislation to allow alkaline hydrolysis, concerned that it "does not appear to respectfully treat human remains" (Powell, 2017).

The Catholic Church's resistance to alkaline hydrolysis is presaged by a long history of antipathy towards practices that break down human remains using fire or hot liquids. In the Middle Ages, deceased nobles were often boiled to separate their flesh from their bones, before being transported to one or more burial plots, as a more economical and hygienic alternative to embalming (Brown, 1981). This practice became known as *mos Teutonicus* ("German custom") due to its popularity in Northern Europe, but was viewed with horror in Italy (Park, 1995), and eventually banned under penalty of ex-communication by Pope Boniface VIII in 1299, "so that the ferocity of the said abuse will no longer tear apart the human body and move the minds of the faithful with horror" (Park, 1995). Cremation had been outlawed in 789 by Charlemagne as it was seen as a pagan custom that rejected the possibility of physical resurrection. In 1884, eight years after the first crematories opened in Germany and England, it was banned in Canon Law by Pope Leo XIII (Bregman, 2010). As the rate of cremation continued to rise in the 20th and 21st centuries, the Church eased these prohibitions to allow cremation "provided that it does not demonstrate a denial of faith in the resurrection of the body." (Catechism of the Catholic Church, 2301). It is clear from these

proclamations that acceptance or rejection of methods of final disposition, including *mos Teutonicus* and cremation, have been predicated on metaphysical ideas about what those methods mean and whether they were seen as continuations of a familiar tradition or as foreign practices that threatened the accepted role of the dead body in the collective imagination.

Changing methods for the final disposition

While burial and cremation may seem so entrenched as to be immutable, methods of body disposal and associated commemorative practices have in fact undergone profound, if gradual shifts throughout human history. Prior to about the 12thC (in Europe) burial took place in fields and woods overseen by family and village communities, but from there shifted to churchyard burials with rituals presided over by priests, and from the 17th-18th century, to purpose-built civic cemeteries controlled by professional deathcare specialists. During the 19th and particularly in the mid-20th century, another slow revolution was brought about by the increasingly popular practice of incinerating rather than burying remains.

A small number of companies are now representing alkaline hydrolysis as a viable and desirable alternative to burial and cremation, and are striving to instigate a new phase of revolution. As mentioned above, these four companies are: “Resomation” (described as “Water Cremation”) which is discursively aligned with cremation; “Bio-Response Solutions” with its clearly high-tech material semiotics; “Aquamation”, described in terms that emphasise its continuity with natural processes and very old traditions; and Qico, a newer entry to the market that provides a difference and value proposition in the aesthetic design of the retort.

To achieve this change, proponents of alkaline hydrolysis need a technical materiality and a narrative that can successfully challenge the normative status of cremation and cemetery burial, just as cremation has to a significant extent successfully challenged cemetery burial, and cemetery burial has entirely successfully challenged churchyard burial (with minor exceptions such as the burial of notables at St. Pauls, London).

The previously mentioned historical changes in the final disposition did not occur in isolation but occurred in the context of change in the wider social, cultural and institutional context. The move from the field to the churchyard occurred in the context of the growing institutionalisation of religion and the beginnings of the widening influence of these institutions in their communities and society. The move to purpose-built cemeteries occurred in the context of modernism, and the rise of secular professionalism in many fields of life, including town-planning. And the first moves from burial to cremation, led by the "Cremation Societies", occurred in the wider context of the valorisation of science, germ theory and "purification", and industrial efficiency (see Laqueur's (2015) for a marvellous account of this).

The four alkaline hydrolysis companies seeking a new move in final disposition enlist a range of narratives about the environment, natural processes, cost-effectiveness, technological progress, and a more personal and gentle alternative to fire. The rest of this paper reports on and analyses this struggle to gain traction in the contemporary zeitgeist.

Research Methods - Material Semiotics

To address the challenges of studying technologies in the making, the research draws on fieldwork in the funeral and cemetery industries and applies a material-semiotic

approach to analyse the alternative material and discursive forms of alkaline hydrolysis for the final disposition of the body.

In adopting a 'material semiotic' approach, the analysis extends on the semiotic tradition of critical interpretation of meaning signified in texts and images, especially advertising, popularised in cultural studies (Barthes, 2015/1957), and applies it to material objects and technologies. Material semiotics however is also closely associated with the wider material turn in the humanities and social sciences, and in particular with the work of Latour, Law and other Actor-Network Theorists (e.g. Law 2015). Their approach to objects and agency is apt for this study in that it focuses on the entangled interplay of materiality in the techniques by which the body is reconstituted by the chemistry and machinery deployed by our four companies, as well as the semiotics constituted by the discursive meaning that is made and offered by the four companies of the process of alkaline hydrolysis. Another key technology-oriented reference here is the work of Don Ihde, whose analysis of human-technology relations (1990, 1999) included an element of semiotic interaction, in which an expanded hermeneutics, beyond texts, turns to the interpretation of things. Ihde's attention to the ways in which meaning is constructed through cultural engagement with and through technological devices as things is useful in the present case. Hermeneutics involves both the influence of technologies on our perception, such as instrumentation itself, a thermometer, map, chart etc. where readable technologies give a representation of the world, and also the act of treating technologies like texts or images which can be critically interpreted as signifying important cultural values and norms.

In the contexts of death, disposal, and memorialisation, similar material-semiotic approaches have been applied to the material culture and spaces of death, such as physical cemetery memorials and personalised memorial mementos (Hallam and

Hockey, 2001). As Arnold et. al. note in their more recent work on death and digital media:

> Artefacts – including, and perhaps especially those produced and used in practices relating to death – are material forms through which cultural meanings, expectations, and politics are made powerfully manifest. These artefacts make material, and thus in some sense legible, the otherwise performative and abstract contours, patterns and politics of any given culture. We can look to these artefacts to interpret or understand how they materialise socio-cultural and historical meanings, norms, ideologies, practices, and values. (Arnold et al., 2018: p.31)

The paper applies this approach to empirical evidence gathered at funeral trade shows, from conventions of funeral professionals, from separate interviews with industry executives and representatives, and from collections of relevant trade literature and company websites, all part of ongoing empirical research into the deathcare industry and its innovations. Qualitative data were gathered at funeral industry conventions in Australia, the US, the UK, and Japan between 2014-2019. Members of this industry regularly come together at conventions to chart the future of death care. Conventions are important spaces for performing and promoting innovation in the industry (van Ryn et al. 2019). They showcase boundary-pushing products and services, but also become a site of friction where 'tradition' and 'innovation' rub up against one another. The products and services presented at such conventions span everything from hearses, urns, and software management systems for funeral homes, to jewellery made from ashes and sealable cadaver pods for repatriation and transport.

At conventions, the authors listened to presentations from professionals and talked to representatives from the established death care industry, and from newer start-ups, and collected marketing materials from trade publications and products (Arnold et al. 2018: 99-103). Conducted for over a decade, this research has allowed us to track the rise (and fall) of many new technologies, and to note their material forms and discursive constructions as they promise to reshape or even revolutionise death culture and memorialisation. The authors also visited many funeral and cemetery-related businesses in the US, UK and Australia, and interviewed designers, company managers and salespersons.

Discussion

Material semiotics are important in a focus on alkaline hydrolysis, less as a chemical process, and more as a technology with particular material forms and particular branded representations: that is, what can be understood from what the machine itself looks like? What appeal (or not) does its design have for professionals and then for the public, and what can be learned from this? The fact that the machine's container is known as a "retort" is coincidentally apropos, as the physical appearance of this container creates an implicit *response*, that is, a retort to the question of what it is and how it works. Discursive appeal too is important both for company marketing but also for our analysis: that is, how are particular descriptions, analogies and metaphors used to describe the technique to the profession and to the public? Regulatory framing is also important to understand: that is, how is such a product "sold" to legislators and regulators who must approve of the technique for the final disposition?

We will now turn to consider the representations made by the four companies in more detail.

Resomation: Alkaline Hydrolysis as Cremation Without Fire

Resomation is a UK company manufacturing alkaline hydrolysis retorts, founded by Howard Pickard and Sandy Sullivan and owned by the Leeds and Bradford Boiler Company. Although the company and its founders are UK based, alkaline hydrolysis is not legal in the UK at the time of writing, chiefly due to resistance from waste-water authorities (for detail see Robinson 2021). Consequently, Resomation operates business-to-business in some states in the US and Canada, where (again at the time of writing) it claims to have disposed of more than two thousand bodies – enough to demonstrate its viability in a technical sense, but not in a commercial sense, where this is but a tiny fraction of the roughly three million annual deaths in the US. The company has also been working to legalise alkaline hydrolysis for the final disposition in the UK, and towards supplying the Netherlands with alkaline hydrolysis equipment as that country moves towards legalisation.

In an evocative article, Philip Olson identified the mode of representation adopted by Resomation as "assimilationist" (Olson, 2014). By using this term, Olson observed that Resomation's material, discursive and regulatory semiotics represent Resomation's implementation of alkaline hydrolysis as being just like cremation (only better). Indeed, it *is* cremation (only better)! For example, when the marketing manager of a company that provides retorts for Resomation as well as traditional cremation was asked whether alkaline hydrolysis is a form of cremation, he responded, "of course it is … the processes are the same" (Olson, 2014).

Figure 1. Examples of alkaline hydrolysis retorts manufactured by Resomation. (Images sourced from Resomation)

It can be seen in Fig. 1 that a Resomation retort, or “Resomator”, is made to closely resemble a cremator. It is similarly sized, clean-lined, rectangular, horizontally oriented, and front-loaded. In its business-to-business communication and on its public-facing websites, Resomation explicitly represents its form of alkaline hydrolysis as “Natural Water Cremation” and as cremation “without flame”. This form of representation is discursively tangled, in that it represents itself through analogy as being akin to its main competitor, cremation, yet also seeks to distance itself from cremation to assert its superiority and desirability through the prefix “water”. The “horseless carriage” was a clear representation of the early motor car because the motor car was a carriage without a horse, but it is not clear that Resomation is cremation without a flame. Flames are inherent to the meaning of cremation, and without burning, the word is a very poor signifier, as the word’s etymology dating back to the 1620s attests. It is an ‘"act or custom of burning of the dead", from Latin *cremationem* (nominative *crematio*), noun of action from the past-participle stem of *cremare* "to burn, consume by fire" (also used of the dead), from PIE **krem*-, extended form of root *ker- (3) "heat, fire."’ (Online Etymology Dictionary)

The company name, “Resomation”, has little to do with water, but was thoughtfully chosen using the prefix “Resoma”, which is a Greek/Latin derivation for “rebirth of the human body”. In gesturing to metaphorical rebirth, Resomation joins others offering ‘green’ alternatives to cremation or standard burial – in particular, proponents of “natural burial” and Recompose’s “natural organic reduction”. In this shared narrative, the body is resolved back to its basic organic components and its rapid and beneficial return to our eco-system is facilitated to be re-used as nature had designed. This narrative suggests that our bodies only borrow those finite organic and inorganic building blocks during our life and that we need eventually to return them. The dead body is discursively produced here not as waste, but instead as a valuable resource. Such a narrative is capable of representing alkaline hydrolysis as a protagonist in a familiar, well understood and attractive story that over-arches, embraces, and contextualises the unfamiliar product in a way that enables both professionals and the public to make sense of it.

In addition to “water cremation”, the technology has also been represented by Bio-response Solutions and Aquamation as “Bio-cremation,” “Green cremation,” and “Eco-Green cremation”, each one aligning it with the familiar (cremation), while also putting a name to the point of difference that they hope is their competitive advantage. And this ‘assimilation’ of alkaline hydrolysis with cremation is not just marketing. It is also important for legislation and regulation. In the states of the US, provinces of Canada and states of Australia where alkaline hydrolysis is legal, it is regulated as a form of cremation, not as a new form of final disposition. It has been successfully argued to be a form of cremation in 20 US states, in Canada and in Australia because, according to the Cremation Association of North America:

1. It processes the body in a form of final disposition.

2. Through this processing, it reduces the body to component or elemental, non-biological parts.
3. It leaves a residue for the family to use as memorial material which is very similar to cremains.
4. The facilities may be housed alongside cremators and are run by cremation staff who need little retraining.
5. The unit looks very similar to a cremator.

Bio-Response Solutions: Alkaline Hydrolysis as New Technology

If Resomation are "assimilationists", in Olson's terms, Bio-Response Solutions are "separatists" (Olson, 2014). Bio-Response Solutions' material and discursive semiotics insist upon the difference to cremation, not the analogy. Although the regulatory framework that provides Bio-Response Solutions with required permissions remains firmly founded on cremation, Joe Wilson, founder of Bio-Response Solutions, remarked to one of the authors, "It's not like cremation", "It is NOT cremation! It's much more high-tech". Looking at the retort (Fig. 2), one might well go further and say that it's not just high-tech in the modernist sense, it's steam-punk!

Figure 2. A Bio-Response Solutions retort. (Image sourced from Bio-Response Solutions)

In this design form, the materiality is unashamedly different from a cremator. It doesn't look much like a cremator (or a Resomator) – it doesn't look like anything but a Bio-Response Solutions retort. The body of the retort is cylindrical, not rectangular like a cremator or a Resomator. It bristles with visible input and output pipes and vents rather than being smoothly surfaced and clean-lined like a cremator or a Resomator. Its material semiotics are clearly high-tech, and it is spoken of by Joe Wilson and others in the firm in terms that distance it from cremation and emphasise its technical superiority. So, for example, where a Resomator remains horizontal, as does a cremator, the Bio-Response Solutions' retort tips to an angle of 45 degrees when in operation, to increase efficiency by keeping the head down, reducing the water required, and therefore the alkali and the energy. The "head-down" position also optimises the reduction of the brain, which can be problematic given that it is well protected from the solution by the skull.

Where Resomation relies on a material and discursive cremation analogy to invoke recognition and understanding, and positions itself in an environmental narrative to invoke a desirable point of difference from cremation, Bio-Response Solutions relies on the trope of providing a technological solution to an environmental problem. 'Technical solutions' and 'environmental problems' are concepts that need no introduction, and in this manner, the material semiotics of Bio-Response Solutions seeks to be understood as contributing to and drawing upon important elements of its current social, cultural and environmental context.

Aquamation: Alkaline Hydrolysis as Natural Decomposition

Aquamation is an Australian trademark used to refer to a small alkaline hydrolysis company operating under the umbrella of "Environmentally Friendly Cremations", a company founded in Australia by John Humphries. Aquamation offers alkaline hydrolysis services for the final disposition to families in Australia in Victoria, New South Wales, the ACT, Queensland, and South Australia. Aquamation services are not well known in the Australian market, as they are offered chiefly by a couple of low-profile funeral companies owned and operated by Aquamation. At the time of writing, Aquamation has not been successful in enrolling a large well-established funeral company (such as InvoCare or Tobin Brothers) to retail its services. Aquamation also exports retorts to the United States and Canada, but its efforts in that market are overshadowed by Resomation and Bio-Response Solutions, both of which are much better capitalised and much better known to the North American funeral industries.

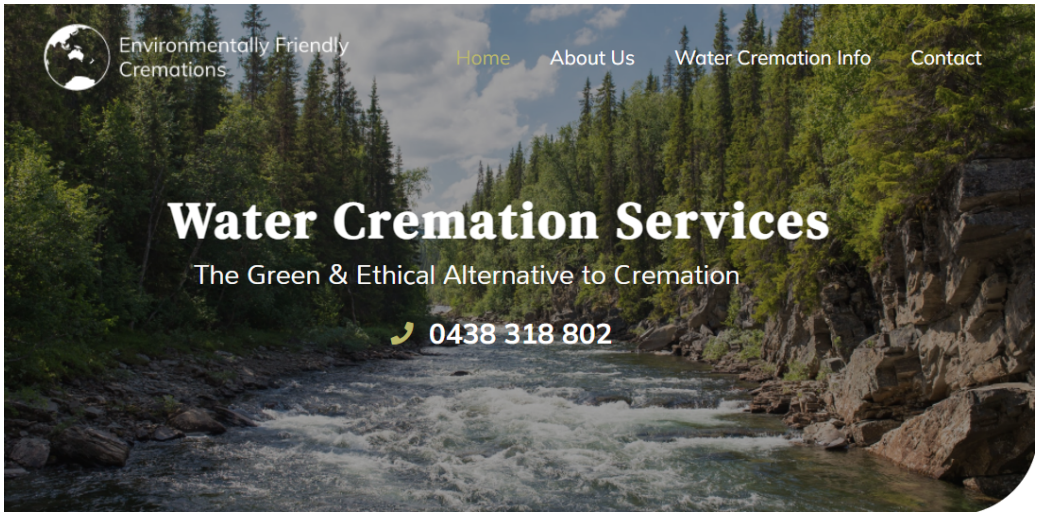

Figure 3. An Aquamation graphic. (Image sourced from Aquamation)

Nevertheless, Aquamation seeks to represent itself in interesting ways. Like Bio-Response Solutions, it represents its form of alkaline hydrolysis as quite different to traditional cremation (though it too has relied on legislation drafted for cremation for its legislative and regulatory permissions). The main thrust of its discursive position is its insistence that Aquamation is a green *alternative to* cremation rather than a *form of* cremation. It represents cremation as a process that produces very problematic carbon emissions: "The toxic mercury emissions have been proven to cause serious health problems for the people living near the crematoriums. These health problems include Cancer, Autism and Stillbirth" (Aquamation website, undated). Aquamation is not at all like cremation in relation to such dangers.

The alkaline hydrolysis service offered by Aquamation is much slower, taking 12 hours or more to break down the body rather than ~4 hours, which is achievable with Resomation and Bio-Response Solution's high-temperature/high-pressure units. This is the case because the Aquamation retort operates at ~95C degrees and at atmospheric pressure, rather than ~150C degrees and a pressure of ~65 pounds per square inch as the other alkaline hydrolysis retorts typically do. The Aquamation unit also operates without power-driven agitators to circulate the solution, which further slows down the chemical process. The material semiotics of the retort itself also presents an interesting point of difference to its alkaline hydrolysis competitors. The unit sits horizontally on a stand, and the body is top loaded in a basket into the solution, rather like being inserted horizontally into a bath. The lid is closed, like a casket lid, but as the unit is not pressurised it can be opened at any time. The solution is moderately heated by elements within the retort, and convection circulates the solution. The process of loading the retort, adding chemicals and monitoring progress is also manual rather than automated. At the early stages in the process, the liquid solution is described by John Humphries as

being a semi-opaque light-blue colour, and not at all unattractive. The narrative here is of a much slower and much more gentle process - like being immersed in running water. Here the company seeks to deploy visual and organic connotations of water, vis-a-vis fire, to represent this as an alternative discursive and material process through associations with water as organic, clean, natural, and life-affirming, as opposed to the destructive, intense and polluting forces of fire.

Qico: Alkaline Hydrolysis as an Aesthetically Pleasing Consumer Experience

Qico is an alkaline hydrolysis biotech company based in Southern California. Its mission is "to provide the world with an environmentally responsible, sustainable, and ecologically beneficial solution by transforming the cremation process from fire to water" (Qico website, undated). It too aspires to a future 'global replacement' of the processual means for cremation – a replacing of fire with water. To symbolise the gentle natural work of water, the company has turned to an entirely different aesthetic in the design of the retort, which resembles a large white nautilus lying on its side (see Fig. 4). The material form of the retort dissociates it completely from the forms of metallic, industrial, high-tech and low-tech retorts adopted by its competitors, and indeed, has been designed from the outset to be a pleasing, almost organic, centrepiece of the committal. Just as cremation of the body is mostly completed 'backstage', to the best of our knowledge all of Qico's alkaline hydrolysis competitors too keep their technologies backstage, whereas Qico is 'basically […] reintroducing the committal ceremony to cremation through the nice shape and design' (Qico transcript p.4). Even the door used to insert the body is shell-like in its design.

Figure 4. The Qico retort. (Image sourced from Qico)

The name of the company also competes with other alkaline hydrolysis companies by taking the consumer away from a focus on the technology per se in favour of a pleasing and symbolically powerful abstraction. The founding designer of the machine named it ‘Qico’ by putting together the word ‘Qi’ (pronounced and sometimes spelled ‘ki’ and referring to the energy or life force that permeates the body and the universe in Chinese and Japanese philosophy and practice) with ‘co’ referring to ‘company’. The composite word ‘Qico’ resonated for him, so it was adopted as the product’s name when it was branded in 2016 (Qico manager, personal communications).

Qico is, then, distinguished from its cremation and alkaline hydrolysis competitors in a number of ways. In terms of the design of the machine and even the name of the product, it looks beyond consuming gatekeepers in the industry to speak directly to end consumers – the bereaved who make the choices. Through its strong emphasis on organic semiotics, Qico seeks to disrupt extant processes of commemoration around the final disposition, bringing the technology of treating human

remains from the hidden backstage to the performative front stage (Goffman 1990), where the final disposition of the body can be directly and proximally witnessed. Standard cremation, a more important competitor than the other three alkaline hydrolysis companies, is a noisy, gritty, hot process that is not conducive to a front-stage performance. By using this more aesthetically designed retort in a process that is silent and sold as "gentle", "natural" and so on, the funeral ceremony can have a new and significant "committal" that can be sold as a point of competitive advantage to funeral directors, and, importantly, as a welcome alternative to families.

Conclusion – a shared ecological narrative

Representing alkaline hydrolysis materially and discursively to the funeral professions and to the public eye in a way that positions the technologies as contributing to and drawing upon contemporary normative values is a vexing problem. But the potential rewards are high. Should "Resomation", "Bio-Response Solutions", "Aquamation" or "Qico" become wildly successful, the brand and its material semiotics (a cremator look-alike, a high-tech steam-punk contraption, a water casket, or a sculptural object) would no doubt become synonymous with alkaline hydrolysis as a generic category, in the way that "Hoover" represents all vacuum cleaners in the UK, and "Google" represents all search engines internationally. None of the competitors, as yet, have managed to achieve this, although they all envisage such a major disruption to the industry and to the market in their futures.

One strategy common to all four providers over the last decade has been to simultaneously link alkaline hydrolysis to cremation, while also distancing alkaline hydrolysis from cremation. On the face of it, this is a strategy that has merit. To introduce a new and unknown technology through analogy with an old and well-known

technology is a move that has been successfully deployed in the past (e.g. horseless carriage, windows operating system, bitcoin wallet). There are genuine similarities to cremation and all four providers make the analogy explicit by including "cremation" in their technology's branding, description, or both. It also makes sense to distance alkaline hydrolysis from cremation. After all, there are important points of difference between alkaline hydrolysis and cremation as techniques, and if alkaline hydrolysis is just like cremation, why not stick with cremation? To achieve this distancing in their representations, these four companies use the prefixes "water", "natural", "eco" or "flameless" and emphasise their ecological credentials in their branding and product description.

To varying degrees, all four companies position the product in an environmental narrative and appeal to a widespread desire to be environmentally responsible. The companies might be unknown, and their product might be unknown, but the problem they claim to address is very well known. The problematic context described is that we are facing an environmental emergency and that every measure that can be taken to alleviate this crisis should be taken. They argue that greenhouse gas emissions and fossil fuel use must be curtailed, and alkaline hydrolysis can help achieve this. Indeed, proponents suggest that the system can be moved entirely off-grid, using solar power and recovered water. Qico not only claims to save energy, but also to have the capacity to produce energy from the effluent (Qico, personal communications). The energy inputs are significantly reduced, and the emissions are not harmful greenhouse gasses and carcinogens but useful plant nutrients. Related to the environmental narrative is the claim that the process is more "natural" and less "industrial" than cremation. The fact that the body is not burned in a variant of an industrial incinerator, but is broken down in water, is described by some as a process that is less violent and much less energetic,

and that may well appeal to some consumers' sensibilities. Also appealing to some sensibilities is the notion that this is something *different*. This is something not many people choose. This is more exclusive. This is the personal and considered choice of the discerning minority (including Archbishop Desmond Tutu!) .

Representing alkaline hydrolysis to legislators and regulators is another problem, and this has been overcome in some US and Australian jurisdictions by analogy. That is, alkaline hydrolysis has been represented in a legal sense as a form of cremation by the US and Australian states and Canadian provinces that have legalised it. In law, it is "flameless cremation" or "water cremation", and the various acts and regulations that have governed cremation for many decades have been amended to embrace alkaline hydrolysis. Amending cremation regulation and positioning alkaline hydrolysis as a form of cremation is less problematic than legislating alkaline hydrolysis from scratch or amending the legislation and regulation that governs burial. Interestingly, Recompose (a company in Seattle that designed a technology for human composting) also took this strategy when successfully applying for permissions required in Washington State, initially, and now in some other US States.

And so it is that thus far, alkaline hydrolysis and its four champions remain minor players. Strategies to escape this position include discursive and material representation through analogy with cremation, and representing points of difference to the analogy. These are strategies that have been successful with legislators in an increasing number of jurisdictions, but are yet to resonate with the funeral industry or its publics. Each of the companies presented here share a story that promises a resource-efficient, effective, economical and environmentally sound method of final disposition, relative to burial and cremation, in a western world that is recognising the need for change. Environmental problems related to fossil-fuel consumption, emissions and

global warming are well known, but the mitigating role alkaline hydrolysis might play, is not. Appeals to naturalness, to the attractiveness of water, to difference, to the provision of nutrients, to technological efficiency, to aesthetics and the option of moving the process to 'front of stage' have all been made, but have not yet created a clear, coherent and fully attractive representation of alkaline hydrolysis for either the industry, their consumers, or the wider public or their markets. But then again, earlier tectonic shifts in the final disposition of the body, from field to churchyard to cemetery to cremator, each took place over many decades, not over mere years.

Acknowledgements

This work was supported by the Australian Research Council grant DP18010314 and the Australian Research Council Grant LP180100757.

Disclosure Statement

The authors have no financial or non-financial conflicts of interest to report.

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Word count: 8533