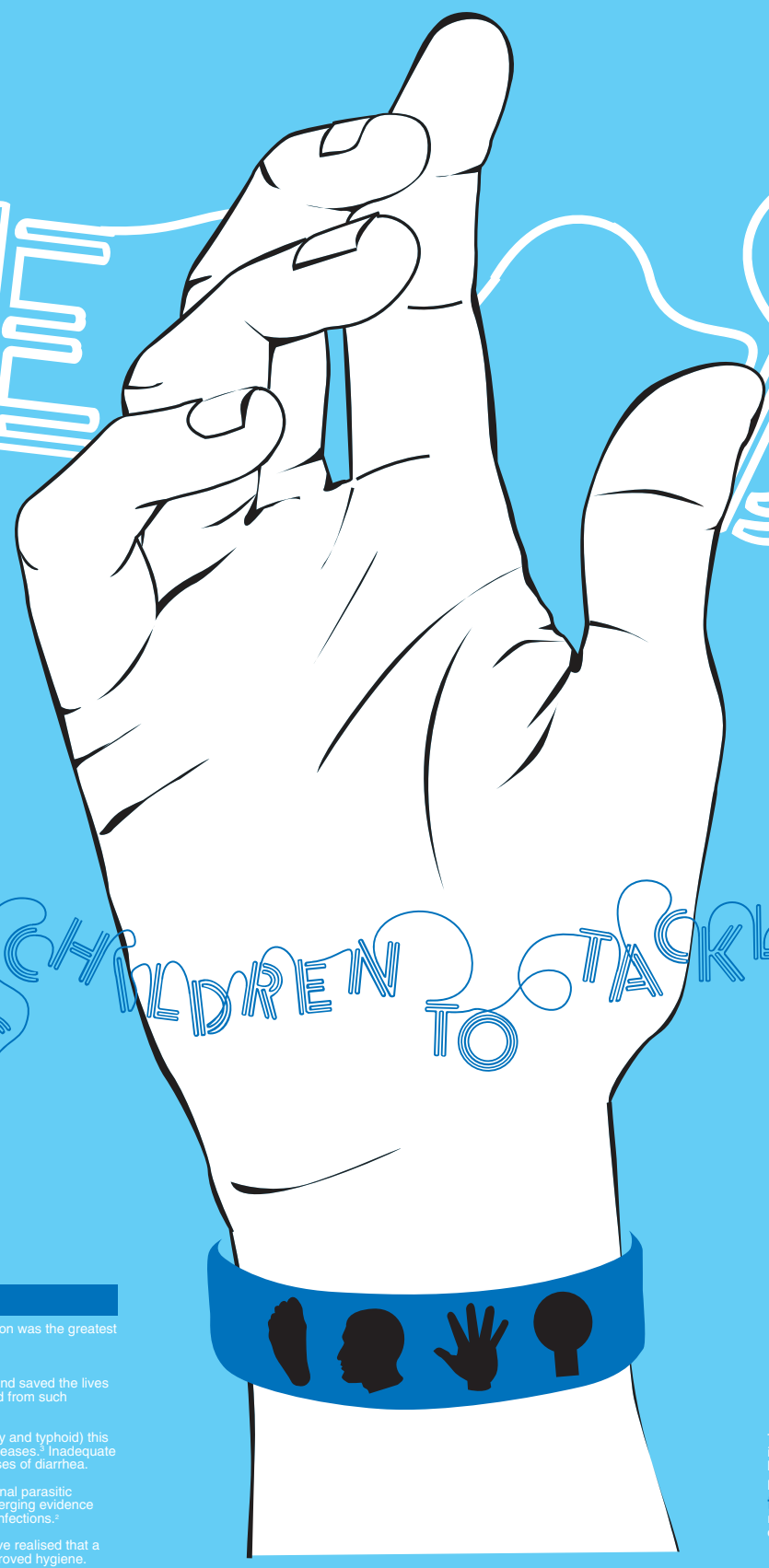
LIFEBAND

EMPOWERING CHILDREN TO TACKLE A GLOBAL ISSUE



1. INTRODUCTION

In January 2007 a poll carried out by the British Medical Journal found that sanitation was the greatest medical milestone of the last century and a half.[1]

Although enhanced sanitation and hygiene methods and facilities have improved and saved the lives of millions in the developed world, many in the developing world have not benefited from such advances.

1.9 million children will die from diarrhoeal related diseases (e.g. cholera, dysentery and typhoid) this year.[2] Of the all the child deaths in the world 18% of them are due to diarrhoeal diseases.[3] Inadequate and unsafe water, poor sanitation, and unsafe hygiene practices are the main causes of diarrhea.

Intestinal worms infect about 10% of the population of the developing world. Intestinal parasitic infections can lead to malnutrition, anaemia and stunted growth.[4] There is also emerging evidence linking better hand-washing practices with reduced incidence of acute respiratory infections.[2]

Traditionally, resources have been focused on water supply, but now providers have realised that a holistic approach is needed, integrating water supply, improved sanitation and improved hygiene.

Research has shown that improved water quality alone can reduce incidences of childhood diarrhoea by 15-20%, the safe disposal of children's faeces leads to a reduction of nearly 40% and better hygiene through hand washing and safe food handling reduces it by 35%.[5] During the UNICEF/IRC roundtable meeting of experts and decision makers in Oxford in 2005 it was noted that:

'Interventions that focus on improving hygiene practices seem to have the greatest impact'[6]

Good hygiene practices are simple and you don't have to understand germ theory to implement them and save lives.

Experience from UNICEF has shown that **informed and motivated children are powerful advocates for improved hygiene in the home.[2]** Children are the people most at risk but are also the most powerful advocates for improved hygiene.

This proposal suggests a simple plan to help educate and motivate children in improved hygiene.

Could educating and motivating children to improve hygiene practice become one of the medical milestones of the 21st century?

2. THE IDEA

There is a need to educate children in good hygiene practices. A key to success is to make this exciting for children, something that will engage them.

In recent years the rubber, charity wrist band has been used to raise money and awareness for a range of charities. At its peak a majority of young people were wearing a wrist band supporting some cause or another. Examples are the yellow 'Livestrong' wrist band which raises money for the Lance Armstrong Foundation (cancer research), or the 'Make Poverty History' white band. These wrist bands became a meaningful but sought-after and fashionable accessory.

We propose to use the wrist band concept primarily to educate and motivate children in the developing world in good hygiene practice and as a spin off idea, to raise awareness and funds in the UK by selling them to the general public.

The basis of the idea is that the WaterAid Bands will have four very distinct symbols representing four key, basic hygiene messages. Children in countries where this is introduced will be given the opportunity to learn what each symbol stands for. When a child can recognise the symbols and memorise and demonstrate practice of the four messages they will be given a WaterAid Band. This idea is based on the grounds that the WaterAid Bands will be highly attractive to children, they will want one and do what is required to get one. Moreover, 'earning' a WaterAid Band through the demonstration of key understandings and skills will help instil the concept that hygiene knowledge and practice is important and has value.

The WaterAid Bands will have four very simple symbols (see below). Associated with each symbol will be a key hygiene practise (see below). These hygiene messages are transferable across gender, culture, religion and language.

- Handwashing with soap and water after going to the toilet and before eating.
- Wearing shoes in latrines.
- Washing face and hands regularly with clean water.
- Using a sanitary latrine instead of going to the toilet in the bush.

The bands are aimed predominantly at children, as these are the people most at risk from diarrhoeal diseases, but that is not the only reason. As stated in the introduction children are powerful advocates of improved hygiene. Children are generally sociable and come into contact with many people and across cultural and gender boundaries.
Not only will the children learn life-saving hygiene practices for themselves but, on earning the WaterAid Band, they will be told that they are now advocates for good hygiene and should be encouraged to tell others what the symbols mean and to look out for others practicing them.

Traditionally hygiene education has come in the form of organised set times for learning in schools and community groups. One of the advantages of the WaterAid Band concept is that this education can take place informally - anywhere kids are playing with each other, walking to the shops or at home – reaching even those children who may not be enrolled in formal schooling. Anywhere the child goes there is an opportunity to pass on the message of good hygiene practice with these highly portable and durable WaterAid Bands. **This concept reinvents the approach to hygiene education, takes it out of class rooms and into everyday lives.** The bands are hard-wearing, waterproof and can be worn at all times. They are also rubber and non-absorbent, so are no more unhygienic than human skin.

Another important advantage is that illiteracy is not a barrier to learning through this process – the symbols will be simple and easily recognisable. The symbols are also transferable to urban settings and rural settings, as well as not being restricted by language. Although hygiene and sanitation practices are specific to particular contexts, the core principles represented on the WaterAid Bands are relevant to the majority of developing countries.

3. Project Implementation

Our idea is for the educational wristbands to form the incentive for children to learn about safe personal hygiene practices.

The field-level implementation of this project is extremely important if the potential impact of the WaterAid Bands is to be maximised. One of the benefits of our idea is its simplicity and therefore how transferable it is as it can be applied within many different contexts. However, we believe, for the bands to be fully effective one must ensure a number of practices are in place.

One of the important features of our proposal is the target audience for the scheme is children. Previous hygiene education studies have focused on educating the mothers and measuring the outcome in children.[7] However, given that children are the population group most at risk from poor hygiene practices, and their potential as powerful drivers for change, we believe a scheme aiming hygiene education at children would be very effective.

We propose that the bands will only be distributed to children once they have completed a relevant curriculum. This is to ensure that the message the bands are putting across is fully understood before they are handed out. It is envisaged that the bands would act as both a prize for demonstrating commitment and understanding of the knowledge and skills within the curriculum as well as an incentive for other children to seek out the knowledge and complete the course. The exact make-up of the syllabus will be dependent on the location of the project, with it being possible to tailor it to suit the specific issues of the area. Because of this **the project can be implemented in both rural and urban settings and is not restricted by religious/cultural sensitivities.**

Another exciting aspect of our proposal is that it enables and encourages pier-to-pier learning amongst children. Various studies have been undertaken that highlight the effectiveness of carefully implemented pier-pier learning, as children are far more receptive to new ideas if they are delivered out side formal educational settings and when disseminated by their contemporaries.[8] Once the bands have been distributed to children who have completed the course, other children will enquire how they got them and the main messages of the hygiene education course will be passed on. The scheme could even be set up to reward children who can prove they are carrying out the things they have learned (perhaps by showing clean hands or keeping a diary) or have encouraged other children to join the programme. This reward may consist of an additional band to indicate that the child has achieved the next level. Again, once a child has received an additional band, this will encourage other children to follow suit and develop their knowledge of hygiene education.

As with all development projects, family and community involvement is a key driver in ensuring the success and sustainability of the scheme. **The benefit of our proposal is that it does not require expensive materials or huge numbers of foreign development workers to ensure its success.** The syllabus can be prepared, using a modification of a generic document, to make it specific for each community. This can be achieved by consulting with the relevant community leaders and asking them how they believe sanitation/hygiene can be improved within their community. This ensures the community feels ownership of the project and addresses their specific needs.

4. Pilot Scheme

In order to determine the effectiveness, and determine the most suitable implementation techniques of our proposal, a pilot scheme could be set up. This could take the form of trial bands being made up and the project being implemented as previously described. It could be trialed in both an urban and rural settings and at this stage the different requirements for the core syllabuses could be assessed. Once the scheme has been in operation for a set period of time the incidences of diarrhoea and other water borne disease could be compared with the pre-project levels. The comparison of this data could then be used, along with monitoring and evaluation studies on the implementation techniques used in the pilots, to form a set of best practice guidelines for the implementation of the project on a lager scale.

5. Project Development

The main focus of this proposal, effective hygiene education for children, can be developed further to broaden the scope of the project. One way of doing this would be to introduce additional bands to recognise different levels of hygiene education. An example of this is **to introduce a band highlighting important aspects of family hygiene**, for example:

- Keeping water pots covered when they are not in use.
- Going to the toilet at a safe distance from water sources that are used for drinking, cooking or other household purposes.
- Washing fruit and vegetables before cutting, keeping cooked food covered and utensils off the ground.

This could be followed by a band to recognise the wearer has completed a further course in the importance of community hygiene. The award of these bands would be similar to the first wristband but could also be dependent on the children demonstrating they have passed on the information they have learnt. For example, **for children to achieve the community wristband they would have to become a 'community hygiene officer'** responsible for promoting safe hygiene practices within their communities. Examples of key community hygiene issues are:

- drinking water from protected sources like handpumps or protected wells, rather than rivers or ponds.
- Ensuring animals are kept away from houses, water sources and latrines.
- Making drainage channels or soakpits to take wastewater away from wells and homes.

Another aspect of the scheme that could be developed is to use the bands for fund raising within the UK. This could take the form of WaterAid selling the bands on their website.

6. The case study

This case study looks at the implementation of a hygiene programme in post war Afghanistan.[9]

In 2001 the Ministry of Public Health (MoPH) estimated that more than 50% of hospital beds were occupied by patients suffering from waterborne and related diseases. There were no sewerage systems in any cities, even in the capital Kabul. Public awareness about hygiene was low.

Before the 1980s, hygiene education was in the school curriculum, and government programmes included health education in all clinics, hospitals and in other gathering places. Health inspectors regularly visited schools, and were responsible for hygiene messages. Literacy was low in rural areas, but higher than today's literacy rates in urban areas (literacy in men 46% in women 16%).

In 2001 the problems identified were high levels of diarrhoeal disease, provision of water and sanitation without good information on their use, little information on existing hygiene education materials and delivery. There was also a lack of consensus (and potential confusion) on the best messages for good hygiene in Afghanistan.

The policy for hygiene education included basic messages, produced through a consultative process and aimed at programme planners and managers in the water, health, education and community development sectors, in both urban and rural areas. The hygiene messages would focus narrowly on the prevention of oral-faecal transmission of disease, and on the promotion of a few (rather than many) healthy behaviours consistent with local custom.

Afghanistan is an Islamic country in which the law of Islam is applicable in all daily private and public activities. In Islam, hygiene is an important religious obligation. Religious leaders in Afghanistan support hygiene messages and have a crucial role in educating and leading changes to improve health and hygiene practices.

Important gender issues identified were that women are the main hygiene educators in the family and that female educators are needed to reach women in the community. It was also found that men and women have highly segregated lives. Children can mix up to the age of about 9, after which girls and boys are segregated. Therefore identifying segregated channels for communicating hygiene messages is vital in this situation.

It was concluded that all hygiene programmes in Afghanistan should plan for men to pass messages to men and boys, and women to pass messages to women and girls (our concept would work in the opposite direction, getting girls to educate women and boys men). There was also a lack of trained personnel and in this situation and joint coordinated action is vital.

WaterAid Band Potential in Afghanistan

As literacy is low in rural and urban Afghanistan the WaterAid Band, with four messages would be an effective method of passing on basic hygiene messages as simple symbols are used. In Afghanistan literacy is especially low amongst females, this further emphasis the need for symbols as women are the predominant communicators of good hygiene practice.

The idea is that once somebody learns what the symbols stand for, they do not need any literature and they can carry this message around with them wherever they go (play, school, home) and pass on the message to their peers and others. Their friends will ask 'what is the band for and how do I get one'.

In Afghanistan hygiene education was focused on adults, our concept proposes using children as the main channel for passing on the message of hygiene. Children up to a certain age can cross many of the barriers that we put in place that may hinder communication e.g. gender, religious, cultural. As children come into contact with many different types of people and are generally sociable they are in a good position to pass on hygiene messages.

It was identified that resources were low for trainers in Afghanistan. Using children and the wrist bands is a very low cost way to spread the messages of good hygiene practices across whole communities.

The case study found that using the existing religious authorities was a good way of integrating hygiene messages. The WaterAid Band Project could be introduced in the places where people gather and from places that people respect, depending on the location.

The key to the wrist bands is that it is simple. There are only four basic messages with symbols representing simple practices. This can be implemented quickly and may therefore also be of use in emergency relief situations, when hygiene conditions can be extremely poor.

(Endnotes)
[1] Sarah Boseley. (2006) Sanitation rated the greatest medical advance in 150 years, The Guardian, 19/01/2007. [2] UNICEF water, sanitation and hygiene strategies for 2006-2015, Economic and Social Council/UNICEF, 23/01/2006. [3] Rehydration Project [Internet] Available From: <http://rehydrate.org/diarrhoea/index.html> [Accessed 21/01/2007]. [4] WaterAid Statistics [Internet] Available From: <www.wateraid.org.uk/uk/what_we_do/statistics/default.asp> [Accessed 21/01/2007]. [5] Esrey, S.A., Potash, J.B., Roberts, L., Shiff, C. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. Bull. WHO 69(5): 609-621. 1991. [6] UNICEF/IRC Roundtable Meeting on Water, Sanitation and Hygiene Education for Schools. 2005. Oxford. pp. 9.
[7] Fewtrell, Kaufmann, Kay et al, Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis, The Lancet, Vol. 5, Jan 2005. [8] Peer Education and HIV/AIDS: Concepts, uses and challenges (1999, UNICEF) [9] Hygiene Education for Afganistan – People and systems for water, sanitation and health, Eng S Najibullah Masoumyar, Dr A G Dost, N Ruck and Dr K Wilson, WEDEC (27th WEDEC Conference), 2001.

Rain Water Catch

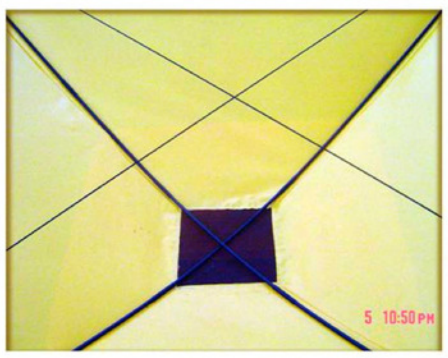
The rain water catch is a fully collapsible light-weight rain collector and storage box.
It is a low-cost, low-tech solution to the lack of access to clean drinking water.



Rain Water Catch Description
- oThe area of the collector is 50.17 square feet
- oThe dimensions are as follows:
  - oCollector - 85" x 85" x 20 1/2“
  - oBox - 31" x 31" x 27"
- oThe unit is entirely collapsible
- oThe collapsed dimension of an entire unit is 23.6" x 7" x 5"
- oThe weight of the entire unit is 8.5 kgs.
- oThickness of the PVC tarpaulin for the box is 0.55mm
- oThinkness of the PVC tarpaulin for collector is 0.15mm PVC; the fiberglass rod holding the collector has a diameter of .9.5mm FRP
- oThere are separate tie-downs for both parts
- oThe rope will hold 20 KGS weight
- oFull, the box weighs about 940 pounds

Rain Water Catch Effectiveness
- oOne inch of rainfall will result in 7.52 inches of water in the box
- oOne inch of water is 4.16 gallons
- oOne foot of water in the box is 49.92 gallons
- oThe box will hold 112 gallons

Rain Water Catch Feasibility
- oInitial price is $120 individually, the price dropping as order size and production increases
- oA heavier collector is an option. It has a 0.55mm PVC tarpaulin for the entire water catch including box and collector with diameter 9.5mm FRP.
- oEstimated price is $135 each, with prices dropping as order size and production increases.








Portable Water Quality Test Kit

Membrane Filtration Apparatus

For the membrane filtration test to be accurate every care must be taken to avoid contamination at any stage. Stainless steel components are currently involved in the process, however, they are heavy and expensive, requiring a lengthy sterilization procedure between tests. This reduces the suitability of any portable kit for use in developing countries.

Sterilisation Strategy

By examining the entire filtration process we were able to assess where contamination could occur. Our prototype design attempts to simplify the process and ensure that only the appropriate components of apparatus remain sterile.

Rigorous testing of our prototype proved that bacterial contamination of components supporting the membrane does not affect results; therefore the only items that need sterilisation are those touching the top surface of the membrane.

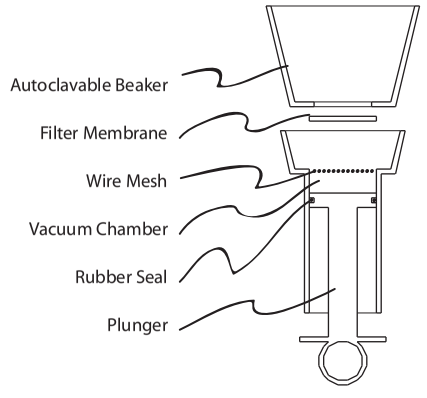
The simplified design suggested below would only require the beaker with a 40 mm hole in the base to be sterilised between tests. Beakers can be pre-sterilised and stacked with one used per test. This would add little additional weight and take up only a fraction more space.

Simplified Technique

Place filter membrane on wire mesh with sterile tweezers
Clamp into place by inserting sterile beaker, forming a seal
Pour known volume into beaker
Pull down plunger forcing water through membrane into vacuum chamber
Remove beaker
Ready petri dish with nutrient pad
Place filter into petri dish with sterile tweezers
Discard filtered sample
Dry top of vacuum chamber and wire mesh

Repeat the process with new sterile beaker
Sterilise tweezers using lighter flame

Minimal On-Site Sterilisation is required



Current Recognised Procedure	Our System
5 main components, mostly stainless steel with some plastic and rubber	3 main plastic components
Complex sterilisation process involving the incomplete combustion of methanol takes at least 15 minutes between each test	No sterilisation required between tests
Number of tests per day severely restricted by sterilisation time:	Number of tests per day only restricted by incubator capacity:
20 samples take minimum 5 hours	20 samples take minimum of 1 hour
(this is not including setting up time and time for travelling between tests)	

Biologically contaminated water is a common cause of disease in developing countries. Investigation into the number of faecal coliforms present in a water source can act as an estimate of pathogens present. Rather than searching for specific pathogens, indicator organisms can provide an estimate to the level of contamination. Escherichia Coli (E. Coli) is a key indicator organism because it is abundant in mammalian faeces and has similar survival characteristics to pathogenic organisms.

Membrane Filtration is an established method for determining the level of E. Coli present. Current applications of this method are more suited to a laboratory environment; however, the suggested approach is applicable to use in remote locations.

Membrane Filtration

Filter known volume through membrane

The filter membrane has a pore diameter of 0.45µm, which is small enough to trap the E. Coli present. This filter membrane should then be placed into a petri dish on top of a pad soaked in nutrient. It should then be left to acclimatise for one hour.

Incubate at 44.5°C for 16-18 hours

Both nutrient and incubation temperature provide favourable conditions for the growth of faecal coliforms. After the incubation period remove the filter membrane and count the number of colonies. Each represents one faecal coliform in the original sample.

Benefits

We now find the incubator to be small and light weight. Furthermore it does not require any electricity for operation or indeed at any time. The revised filtration apparatus is also lighter and requires less time to prepare primarily due to reduction of sterilisation required. The entire kit could be used remotely for a multiple tests, requiring little base camp preparations. Both filtration apparatus and incubator are more simply manufactured with hopes that fabrication could be done locally.

Research and Development

Given that faecal coliforms are killed at 82°C it is suggested that the beakers could be sterilised by submersion in boiling water for an appropriate duration further reducing the need for a base of operations more complicated than a camp fire.

Early experiments performed suggest an incubator may remain effective despite a wider variation of incubation temperature. This could help alleviate need for such stringent controls on environment and make design easier.

Further prototyping must be carried out to ensure all incubation requirements are met. Variables include phase change substance used and the strategic shape of the vinyl bag influencing solidification process.

Portable Phase Change Incubator

Current water quality test kits require heavy equipment; the bulk of which is the incubator. This often requires extended periods of recharging and a connection to the mains. In remote locations electricity supply is often intermittent or entirely absent. As a result these kits remain unusable despite their necessity.

Design Concept

By using a phase change material, the need for electricity can be eliminated.

Produce roughly 600 grams of sodium acetate solution with a freezing temperature of 44.5°C. This can be achieved using a ratio of approximately 10 parts sodium acetate to 9 parts distilled water.

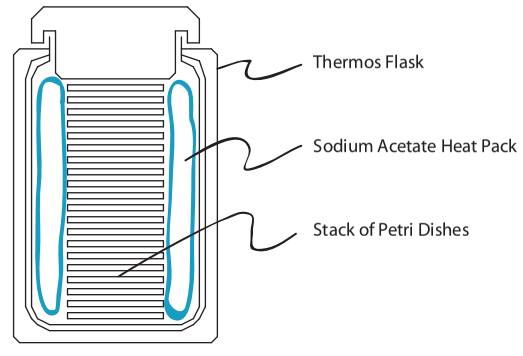
Seal in a vinyl bag with an activator disc (see UK patent no. 4,077,390) to form a heat pack. The exact shape of the vinyl bag should be suitable for this application.

Warm heat pack in boiling water until solution is entirely melted hence storing the latent heat. Then allow to supercool down to room temperature.

Enclose heat pack within wide mouth thermos flask capable of housing both the heat pack and a stack of 20 petri dishes.

When incubation is required activate freezing process within heat pack, which will raise temperature within flask to 44.5°C and maintain temperature for 18 hour period.

After incubation remove heat pack and boil to melt sodium acetate solution ready for next incubation cycle.



Basic Principles

Latent heat is released during the phase change from liquid to solid. During this transition the energy liberated will in effect keep the substances temperature constant.

Supercooling refers to a stable liquids' temperature dropping below its freezing point without solidifying. If a crystal is formed in the supercooled liquid it will trigger solidification of the entire volume.

The combination of these effects means that supercooled sodium acetate solution can be triggered to solidify when required. This in turn will raise the solution's temperature to its freezing point and remain there until it has solidified entirely.