

## Skin injuries caused by new riot control agent used against civilians on the West Bank

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### Abstract

A new riot control agent, used by the Israeli army against civilians protesting about the Separation Wall on the West Bank, has been reported as causing severe skin injuries. We obtained one of the munitions and have identified the contents as capsaicin with an inert carrier and a dispersal agent. This corresponds to the commercially available 'Pepperball Tactical Powder'. Skin injuries of the severity described have not previously been reported with this agent, and would be difficult to manage for clinicians who were unaware of the nature of the agent.

**Keywords:** *Capsaicin, Pepperball, Riot control agent, Skin injury, West Bank*

Severe skin injuries are a feature of a new riot control weapon used by the Israeli army against Palestinian and Israeli civilians protesting about the erection of the Separation Wall on the West Bank. Following reports of the use of this weapon [1] and others, which the Israeli army refused to identify [2], we obtained one of the munitions and have identified its contents, which we report on here. We also describe severe skin injuries that have not been reported previously following the use of chemicals identified in the weapon.

### Methods and Results

This new munition is fired as a pellet (Figure 1). Weighing just over three grams, it consists of a thin rigid plastic casing (diameter 17.2 mm) and



Figure 1. The riot control agent.

some 2.45 g of white powder. The contents of the pellet are under pressure, which ensures that the casing ruptures on impact and enables the contents to be discharged. The powder was extracted from one pellet under ventilation in a laboratory fume cupboard and a portion subjected to analysis by Fourier Transform Infrared Spectroscopy (FTIR). The remaining powder was sent to the United Kingdom where it was split into several portions for further analysis. Two independent laboratories (Analytichem, Solihull, West Midlands, and the Laboratory of the Government Chemist, Teddington, Middlesex) were commissioned to do this work.

Extensive laboratory work was required to identify the munition's contents, summarised in Table I. Fusion of the powder with solid sodium hydroxide on a nickel spoon and reaction with molybdate reagent confirmed the presence of silicates. A sodium carbonate test indicated the presence of a sulphate compound. Subsequent infrared spectral analysis of the powder (using a potassium bromide disc technique confirmed unequivocally that it was barium sulphate. (Silicates and sulphates have similar infrared spectra and identification can be confusing.) Extraction of the powder into dichloromethane and subsequent infrared spectral analysis (by FTIR) indicated the presence of a capsaicin compound but the specific type could not be identified. Evaporation of the extract suggested something with a pleasant flowery odour not unlike vanillin.

Analysis of the powder by the Laboratory of the Government Chemist confirmed these findings. An infrared spectra of a chloroform extract of the powder (by FTIR) identified the presence of silica as well as the possible presence of a sulphate (the best library spectrum match was to sodium sulphate). In addition the spectra were consistent with the presence of organic amides. A match with spectra of compounds in the instrument library gave an 87% match to a reference spectrum of *N*-vanillyl-10-undecenamide (one of a number of synthetic capsaicin compounds). A nuclear magnetic resonance spectrum of the chloroform extract was

Table I. Analysis of riot control munition and possible commercially available candidate.

Laboratory/Supplier	EOH Lab*	Analytichem <sup>+</sup>	LGC <sup>•</sup>	Pepperball Technologies <sup>□</sup>
Physical Appearance	Thin rigid red plastic casing			Pepperball Tactical Powder. Material safety data sheet information
Laboratory Investigation	Casing opened in fume cupboard with exhaust ventilation External Diameter: 17.19 mm Powder in capsule under pressure White powder	Infrared spectra (potassium bromide disc technique) confirms <i>barium sulphate</i>		Non-volatile
Content				Finely ground dense powder (S.G. 3.98) white to off-white/buff colour
Weight Ratios	2.45 g powder	Presence of small quantity of organic compound(s) on more prevalent inorganic solid		0.5% (w/w) mixture of active organic component with proprietary combination of inert carriers and dispersion agents
Fourier Transform Infrared Spectroscopy	Tentative identity • <i>sodium bisulphate</i>	Dichloromethane extract spectrum indicates: • presence of <i>capsaicin</i> compound of unknown identity	Chloroform extract indicates presence of: • <i>silica</i> • <i>a sulphate</i> (best instrument library	Agents identified as: • non-crystalline amorphous precipitated <i>silica</i> • <i>barium sulphate</i>

(continued)

Table 1. (Continued).

Laboratory/Supplier	EOH Lab*	Analytichem <sup>+</sup>	LGC <sup>•</sup>	Pepperball Technologies <sup>□</sup>
		Potassium bromide disc technique confirms <ul style="list-style-type: none"> <li>• <i>barium sulphate</i></li> </ul>	match is to sodium sulphate) <ul style="list-style-type: none"> <li>• <i>organic amides</i> (instrument library gives 87% match to reference spectrum of <i>N-vanillyl-10 - undecenamide</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• active component <i>capsaicin</i></li> </ul>
Other Laboratory Investigations		Fusion of powder with solid sodium hydroxide on nickel spoon and reaction with molybdate – confirms presence of <i>silicates</i>	Nuclear Magnetic Resonance Spectroscopy Chloroform extract spectrum consistent with presence of: <ul style="list-style-type: none"> <li>• <i>aliphatic hydrocarbon</i></li> <li>• <i>aromatic, alkoxy and carbonyl compounds</i></li> <li>• <i>possible aldehydes</i> (range of absorption and low signal make characterisation difficult)</li> </ul>	
		Dichloromethane extract evaporate has pleasant flowery odour similar to <i>vanillyn</i>		

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<sup>□</sup>Pepperball Technologies, San Diego, CA 92121.

consistent with an aliphatic hydrocarbon and the presence of aromatic, alkoxy and carbonyl compounds and possibly aldehydes, but both the range of absorption and the low level made characterisation difficult.

The results from the two UK laboratories have enabled us to track down a candidate munition. Called 'Pepperball Tactical Powder', its material safety data sheet describes it as a non-volatile finely ground dense powder (specific gravity 3.98) with a 'white to off-white/buff' colour. The active component is capsaicin (the pungent ingredient in chilli peppers), present as a 0.5% (w/w) mixture with a 'proprietary combination of inert carriers and dispersion agents' identified as barium sulphate and non-crystalline amorphous precipitated silica [3]. Results for both the laboratory investigations and the contents of the 'pepperball' as described in the safety data sheet (SDS) for the product are shown.

The powder is described in the SDS as having a pungent odour, as well as irritant properties causing symptoms that may include coughing, sneezing, burning eyes and skin, nausea and possibly vomiting. When skin contact occurs the advice is to wash with copious amounts of soap and water to avoid further exposure and to flush the skin with copious amounts of cool water to minimize the irritant effect [3].

## **Effects**

The refusal by the Israeli authorities to identify the agent used against the peaceful protestors left both clinicians and injured uncertain of the treatment necessary to prevent significant damage to the skin. Capsaicins are known to cause erythema [4], but we are not aware of any other reports that describe skin injuries as severe as those we document here. We have obtained signed affidavits from three Palestinians affected by exposure to the contents of the riot control agent. Figure 2 shows the skin injuries one individual received. He reported that he was participating in a peaceful demonstration against the illegal 'Separation Wall' running through Palestinian Territory [5] on 28 April 2005 when he was shot at from a distance of not more than three metres. Once injured, he described the sensation as like an electric shock or sting and he became extremely agitated. He was taken to an ambulance where ice cubes were applied to the skin injuries. A white powder similar to salt was noticeable around the injury spots. Some hours after exposure the injury site near his waist began to swell as did other injury locations. On presentation at hospital the following day he reported that doctors were mystified by his injuries and disbelieving of his claim that they had been caused by a munition. He reports that the injury sites then became infected, and healed before developing 'scar' tissue, which subsequently disappeared, to be replaced about a month and a half later by 'black, dark blue spots'.

Another of those injured reported having been hit by four pellets that initially caused pain. He reported that he lost consciousness for some time,



Figure 2. Skin lesion caused by the agent.

then recovered his senses with his skin injuries turning a red-black colour, and the pain gradually decreasing over a number of days. A third individual reported having taken one of the plastic balls home, where it subsequently burst when his family was asleep in separate rooms in the house. He maintains that all the family felt nauseous from the smell and that the house had to be thoroughly ventilated for two hours, with individuals wiping their faces with water for an hour or more to obtain relief.

### **Comments**

The 'Pepperball tactical powder' pellets are clearly designed to irritate the skin. However, the skin injuries that occurred in the two individuals are far more severe than the effects that the material safety data sheet for the product suggests may occur. Material safety data sheets have guidance which is adequate for those involved in either the manufacture or professional handling of the product, where there is opportunity to resort to the recommended treatment measures should exposure occur. For civilians injured in a peaceful march or demonstration and where treating clinicians have no knowledge of the effects of exposure to the capsaicin pellets and how to ameliorate these, far more severe injuries, such as those we describe, are inevitable.

It may seem surprising that the Israeli authorities chose not to identify the munition used in the demonstration, because it is not an unknown product. However, military forces frequently refuse to disclose information in ongoing operations in case it jeopardises their activity. The situation on the West Bank is also very sensitive politically, and Israel will not want to attract

unfavourable attention if this can be avoided. Although a relatively new technology, 'pepperballs' are widely used by police forces, particularly in the United States, where they have even been used in domestic disputes to quell individuals [6]. A press release by the manufacturer, Pepperball Technologies, Inc, claims that 'Pepperball products' are in use by more than 3000 law enforcement agencies around the world. Products available include the pepperball itself, which will shock individuals when they are struck by the powerful 'yet less-than-lethal kinetic impact of a hard frangible pepperball round and the release of potent PAVA (Capsaicin II) pepper super-irritant'. The available technology is said by the company to enable clouds of the chemical agent to be created for crowd control purposes, breaking barricades, or extracting unauthorised individuals from secured premises [7].

A good reason for the Israeli military's refusal to identify the 'Pepperball' could be the possible perception of its use in the context of the conflict between Israel and the Palestinian territories. Riot control agents are forbidden in warfare under the terms of the 1993 Chemical Weapons Convention (CWC) [8]. However, these same agents can be used for domestic policing purposes and this is perfectly legal. This grey area threatens to undermine the CWC, particularly in situations such as we describe here. Israel is a signatory to the CWC, but has yet to ratify the treaty [9], so while not bound by the terms of the treaty Israel is expected not to undermine it. Israel would probably argue that a demonstration against the 'Separation Wall' was a purely domestic policing affair, but the Palestinian population would not be of the same mind. We therefore question the use of the 'Pepperball' against demonstrators protesting about the erection of the wall. Not only is its use an escalation in the range of riot control agents (previously largely based on the chemical CS [2-chlorobenzalmalonitrile]) [10] used to quell demonstrations, but in the context of the West Bank the legality of capsaicin-type munitions is clearly a matter of concern. Perhaps the use of agents like the pepperball need to be seen in the context of other weapons used in Israel/Palestine, such as the sound curdler and sonic boom [11]. All these weapons are designed to seriously disrupt behaviour patterns and in many cases force people to leave an area.

It is surprising that no other reports have appeared of serious skin injuries arising from the irritant properties of the capsaicin present in the pepperball. We were asked to help identify the contents of a small red plastic ball, discharged at a demonstration, and which was said to cause skin injuries. Our investigation has enabled us to be reasonably confident that we have identified the weapon and that it was a 'Pepperball'.

### **Contributors**

Alastair Hay was responsible for planning the analytical approach, supervising its execution and writing the manuscript. Rita Giacaman and

Steven Rose were responsible for writing and editing of the manuscript. Ramzi Sansur carried out some early laboratory analysis and contributed to writing and editing the manuscript.

### **Conflict of interest statement**

We declare that we have no conflict of interest.

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