

Consumer Safety Research Programme

Fluorescent Lightsticks

14 October 1999

LFX/40/110 E²

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1. Abstract

- 1.1 Lightsticks are commercially available products usually presented as safety or toy novelty products to provide short-term fluorescent lighting during darkness.
- 1.2 The lightsticks comprise of semi-clear or coloured polyethylene tube containing two organic chemical components, an activator solution and an oxalate solution which, when mixed, reacts to give a fluorescent light.
- 1.3 Analysis by LGC has shown that the active chemicals generally found in lightsticks are phthalate esters, hydrogen peroxide, oxalates and anthracene compounds. Given that there are only small quantities of each chemical compound present in lightsticks, toxicological advice suggests there is minimal risk to health, although there is limited toxicological information on certain chemicals particularly on the anthracene compound.
- 1.4 Recent concern has again been expressed as the result of deliberate misuse by users extracting the contents and applying to their skin and/or lips and traders supplying poorly constructed smaller plastic tubes containing the activated chemical compounds taken from other lightsticks.
- 1.5 LGC under DTI's chemical survey work programme has undertaken a further review of lightsticks available on the UK market with respect to composition, toxicity and labelling.
- 1.6 The outcome of LGC's review is that the composition and construction of the lightsticks currently available on the UK market has remained largely unchanged. Current toxicological advice remains unchanged with repeated concerns in the event of frivolous misuse of the lightsticks.
- 1.7 The problem continues to be one of misuse by either the user or unscrupulous traders. Advice given to consumer protection agencies is; provided the chemicals are contained in robust plastic tubing with good labelling (to remove any ambiguous wording which could encourage misuse), these products are not likely to present a risk in normal usage.

2. Introduction.

- 2.1 DTI first asked LGC to analyse fluorescent lightsticks in 1978 to identify and determine the dangers presented by the chemicals in these products. The lightsticks available at that time were examples of safety/emergency lightsticks generally available for use in emergency or military situations either as markers or emergency lighting.
- 2.2 The safety lightstick examined consisted of a polyethylene tube of 150mm length and 15mm diameter. The tube contained two organic chemical solutions, one of which was contained within a 7.5 mL glass ampoule. The solution in the glass ampoule was confirmed as an oxalate/anthracene compound in dibutyl phthalate solvent. The second solution was

confirmed as a hydrogen peroxide activator in a dimethyl phthalate solvent. When the two organic solutions are mixed together, by gently bending the plastic tube and breaking the glass ampoule they react to give a fluorescent light.

- 2.3 During the 1980's new novelty types of fluorescent lightsticks were being encountered. The main differences from the original safety lightsticks were that the polyethylene tubes were longer and thinner containing less chemical solution. The chemicals compounds were found to be the same as those in the original safety lightstick, although the activator solution was now contained in the glass ampoule with the oxalate/anthracene solution surrounding the glass ampoule.
- 2.4 Toxicological advice concluded that although these products contained potentially hazardous chemicals there was a "negligible risk for exposure" provided that the contents were not accessible. Where contents were accessible e.g. where there was a removable end cap to the plastic tube advice was to withdraw them from the market.
- 2.5 In 1998 it was reported that the contents of fluorescent necklaces were being applied by partygoers to their lips to impart a green or pink fluorescent glow. Analysis of the chemical constituents of the necklaces indicated a phthalate ester activator and a dye. Minor swelling and soreness on lips and mouth was reported
- 2.6 DTI requested LGC to investigate fluorescent lightsticks currently available on the UK market with a view to re-assessing any potential hazard.

3. Sampling

- 3.1 'Novelty' shops were used to acquire representative lightsticks and direct mail order. The internet websites were also visited to obtain other potential suppliers. A list of the samples obtained are shown (with any associated warning labels) in Table 1.

4. Analysis

- 4.1 The construction of the novelty fluorescent lightsticks were found to be of a thin sealed semi-transparent polyethylene tube containing a transparent liquid (activator solution) and a glass ampoule containing a coloured liquid (oxalate solution). The safety lightsticks were constructed differently using a coloured wider diameter sealed polyethylene tube containing a coloured liquid (oxalate solution) and a glass ampoule containing the transparent liquid (activator solution).
- 4.2 The glass ampoule(s) and the surrounding fluid was extracted from plastic tube by carefully cutting and removing one end of the plastic tube; a sharp scalpel was sufficient to cut the thinner plastic tubes used of the novelty lightsticks, but in the case of the safety lightsticks a hacksaw was required to cut the plastic casing. Some care was needed to remove intact the glass ampoule(s) from the novelty lightsticks, i.e. bracelets and headbands, as the glass ampoules were tightly packed and could be easily broken.

- 4.3 The activator solutions from the ampoules and the surrounding liquid were analysed by Thin Layer Chromatography (TLC) and Gas Chromatography-Mass Spectroscopy (GC-MS). The results are shown in Table 2.

5. Toxicological Assessment

- 5.1 Given the newly reported frivolous misuse of the contents of novelty lightsticks, toxicological advice was reviewed based on up to date information on the chemical constituents of these products.
- 5.2 In summary, despite the limited toxicology information relating to the anthracene compound the advice remains that with the small quantities of chemicals involved and the very limited potential for exposure there is minimal risk to health if properly used.

6. Discussion

- 6.1 Analysis shows that the construction and composition of the lightsticks obtained by LGC has not fundamentally changed from the lightsticks examined 1987. The same chemicals are present with the same potential hazards.
- 6.2 Current toxicological view remains unchanged as the quantities and types of chemicals being used present minimal risk to health although there was due concern in the event of frivolous misuse, i.e. deliberate application to skin and lips.
- 6.3 From the samples examined, the sealed plastic tubes used to contain these liquids were robust and would require more than accidental damage to enable the contents to be ingested or come into contact with skin or mucous membrane.
- 6.4 It was observed that some lightsticks are labelled as “non-toxic”. This statement could be misleading users into believing that the contents of these products present absolutely no risk to health even if misused.

7. Table 1. Samples & Warnings

| Sample | Description | Warnings on packaging |
|----------|---|--|
| 83015272 | Glow Jewelry Earrings clip-on hoops and headband: A semi-transparent plastic tube (5mm Ø & length 650 mm) containing 3 glass ampoules (each 2mm Ø & length 180 mm) and a colourless liquid (0.5 mL). Each ampoule contains a different coloured fluorescent liquid (0.75 mL): yellow, red and blue. Contains 2 mL total fluid. | Do not puncture or cut plastic tube. This product contains one or more small glass ampoules inside the plastic tube. Ingredients are non-toxic and non flammable, but may permanently stain clothing or furniture. Contact with skin or eyes may cause temporary discomfort. In case of skin or eye contact rinse thoroughly with water. Do not drink or ingest contents. Do not leave product in direct sunlight or expose to high temperature. After use dispose in refuse container. MAGIC IN THE NIGHT GLOW JEWELRY IS NOT RECOMMENDED FOR CHILDREN UNDER FIVE YEARS OF AGE UNLESS SUPERVISED BY AN ADULT. NON-TOXIC. CE Marking. |
| 83015274 | Glow Jewelry Earrings clip-on hoops: A semi-transparent plastic tube(5mm Ø & length 205 mm) containing 1 glass ampoule (2mm Ø & length 180 mm) and a colourless liquid (0.25 mL). The ampoule contains a Neon green fluorescent liquid (0.75 mL). Contains 1 mL total fluid | Warning as stated on sample 83015272 |
| 83015275 | Light-stick Bracelet; A semi-transparent plastic tube(5mm Ø & length 205 mm) containing 1 glass ampoule (2mm Ø & length 180 mm) and a colourless liquid (0.25 mL). The ampoule contains a Neon green fluorescent liquid (0.75 mL). Contains 1 mL total fluid. | Do not puncture the plastic tube. The ingredients in lightsticks are non-toxic and will not cause injury to the eye but may cause temporary discomfort in case of eye contact, thoroughly rinse with water. |
| 83015276 | Safety-Light: An orange coloured plastic tube (14 mm Ø & length 130 mm) containing a glass ampoule (7.5 mm Ø & length 125 mm) and a fluorescent liquid (7.5 mL). The ampoule contains a colourless liquid (2.5 mL). Contains 10 mL total fluid | Keep in original foil wrap until ready to use. Do not puncture or cut plastic container. Ingredients are non-toxic and non flammable, but may permanently stain clothing or furniture. Contact with skin or eyes may cause temporary discomfort. In case of skin or eye contact rinse thoroughly with water. Do not drink or ingest contents. Do not leave lightstick in direct sunlight or expose to high temperature. After use dispose in refuse container. Not for use by children under 5 years of age without adult supervision. |
| 83015858 | Lightstick A plastic tube (14 mm Ø & length 130 mm) containing a glass ampoule (7.5 mm Ø & length 125 mm) and a yellow fluorescent liquid (7.5 mL). The ampoule contains a colourless liquid (2.5 mL). Contains 10 mL total fluid | Warning as stated on sample 83015276 |
| 93005766 | Mini Chemical Light: A semi-transparent plastic tube measuring 4.5 mm Ø & length 37 mm containing a yellow fluorescent liquid. Contains 0.25 mL total fluid | No warnings |

7. Table 2. Analyses

| Sample | Description | 9,10-Bis(phenylethynyl) anthracene. | Bis(2-carbopentyloxy-3,5,6-trichlorophenyl) oxalate. | Dibutyl phthalate. |
|----------|------------------------------------|-------------------------------------|--|--------------------|
| 83015272 | Colourless/blue coloured liquid | Not detected | Detected | Detected |
| 83015272 | Yellow coloured liquid | Detected | Detected | Detected |
| 83015272 | Red coloured liquid | Not detected | Detected | Detected |
| 83015274 | Green coloured liquid | Detected | Detected | Detected |
| 83015275 | Yellow coloured liquid | Detected | Detected | Detected |
| 83015275 | Colourless to blue coloured liquid | Not detected | Detected | Detected |
| 83015276 | Orange coloured liquid | Detected | Detected | Detected |
| 83015858 | Yellow coloured liquid | Detected | Detected | Detected |
| 93005766 | Yellow coloured liquid | NOT TESTED | | |