**Figure 25.1** Some examples of foreign materials. Reproduced with permission of Paul Davies.

The complex nature of the chocolate manufacturing process can lead to further sources of physical contamination. Many items of equipment have moving parts, which can, if problems occur, come into contact with other parts of the equipment and cause metal shavings to enter the process. Examples of such equipment are storage tanks with stirrers, conches, screw feeders, pumps, mixers, temperers and depositors. Other sources of metal contamination include nuts, bolts and other fixings that can wear loose over time and fall into the process, enrober grid wires, which can be prone to breakage, and sieves, which although providing protection against foreign material, can themselves become a source of metal contamination if they break.

Sources of physical contamination are not only metal – problems can also occur through the failure of rubber seals and gaskets, the damage and fraying of conveyor belts and the breakage of plastic moulds, mould carriers and other hard plastic items.

The most effective way to control such contamination is through preventative maintenance – the identification of potential equipment failures and implementation of a regular schedule of inspection and upkeep. Also, prompt reaction to breakages and equipment failures is essential to minimise contamination – there should be, for example, a procedure to deal with mould breakages, whereby the line is stopped, broken moulds removed and replaced, plastic pieces cleared from

the area and a number of moulds either side of the breakage removed to prevent mould fragments potentially entering the product. The aim is to ensure that all fragments of mould plastic are recovered from the area.

### 25.4.3 Physical hazards from failures of prerequisite programmes

The diligent, attentive behaviour of all personnel associated with the production process is essential to minimise the risk of physical contamination of the product. Depending on the nature and scale of the operation, the manufacture and packing of chocolate products can be quite labour intensive, with significant amounts of product handling, for example, the hand packing of assortment boxes. Also production plants can often have areas where the product is exposed to the general environment, such as conveying and wrapping processes. Because of this, there is a risk that foreign material could enter the production process and it is essential that good manufacturing practices are thoroughly applied in the production room. Important procedures are described below.

#### 25.4.3.1 For the factory employees

It is necessary to provide suitable overalls without buttons and ideally only those with inside pockets. In addition effective hair coverage (which may include beards) is required, together with restrictions on the wearing of jewellery, nail varnish and false nails. Loose items must be avoided, other than those essential for the job, for example suitable one-piece pens without lids. Employees must avoid placing loose items, such as pens or tools, on top of processing equipment.

#### 25.4.3.2 In the factory

The use of glass in the production rooms should be minimised and essential glass items protected, for example lighting, and a register should be maintained of glass and hard shatterable plastic items, which must be regularly checked for damage. The use of wood should be very limited, as it is prone to splintering. Wooden pallets should be restricted when possible to the end of the production line, where the product is already wrapped and hence protected.

#### 25.4.3.3 Provision of suitable tools

Cleaning materials should be fit for purpose and designed to minimise the generation of physical hazards – for example brushes should have resin-bonded bristles, cleaning scrapers and shovels should be disposed of if they become damaged. Wire brushes should be avoided. Tools used in the production room, such as knives, scrapers and scoops, should be sturdily constructed and have clearly identified storage locations. Regular checks should be carried out to ensure that they are present and in good condition.