Information sheet

Glass beer bottles and ultra violet light

Bottle colour, lightweighting and the effect of ultra violet light on beer quality

This information sheet has been prepared as part of WRAP’s (Waste & Resources Action Programme) GlassRite Beer, Cider and Spirits project. The project, amongst other objectives, aims to encourage further lightweighting of these bottles, thereby reducing the tonnage of glass entering the waste stream and improving resource efficiencies.

One of the major concerns within the beer (lager and ale) sector is ‘If beer (lager and ale) bottles are made lighter and thinner, will more light get through the bottle and affect the product?’ Due to this concern, a piece of work was carried out by Glass Technology Services (GTS) and Sheffield University to better understand the relationship between beer glass bottle design and colour. This factsheet aims to provide information on the protection from light in lightweight glass beer bottles.

**Beer, light and the bottle**

Beer is known to develop a ‘light struck’ flavour, even after brief exposure to light. Different beers suffer this effect to varied extents dependent on the beer ingredients used. Lightstrike is also sometimes known as ‘skunking’ due to the distinctive aroma. The resultant flavour or aroma could be considered undesirable, whilst others believe it adds character to a beer.

To minimise this effect beer has traditionally been bottled in amber glass which reduces the transmission of light at the wavelengths where the chemical reaction occurs. In addition to glass colour, transmission of light through the glass is also affected by its thickness.

**The prevention of lightstruck flavours**

Beer manufacturers have developed many ways of preventing or reducing the intensity of lightstruck flavours. These fall into three main categories:

- protective primary containers: packaging the beer directly into a protective container;
- secondary packaging: packaging the primary container in a second layer of protective packaging; or,
- beer composition: modifying the beer itself to reduce its susceptibility to become light struck.

As the focus here is on primary packaging, this is explored in more depth below.

**Glass bottle colour and thickness**

If 100% protection from light was the only requirement for beer packaging, then cans would be the best option. However, for a number of reasons glass is also a favoured container choice for beer.

Traditionally amber is the preferred colour, as this is recognised as offering the best protection against light. However, many brands see green and clear bottles as being more distinctive than amber.
The light protective qualities of a glass bottle (or any material) are governed by the Beer Lambert Law which defines the relationship between the light absorption of a material and its thickness.

To investigate the relationship between light transmission and glass thickness, a range of lightweighted and non-lightweighted bottles were assessed, and different glass colour (amber, green and flint) and thickness samples.

**Glass colour**
The results of the study indicate that transmission is greatest in flint (clear), then green, with amber glass blocking the most light.

Green and flint glass can allow the transmission of between 15% and 75% of light in the critical wavelength respectively.

**Glass thickness**
Studies on the thickness of the different colours of glass showed that, in the case of amber and flint bottles a reduction in the thickness of glass - to reduce the bottle weight - does not significantly reduce the protection from light, even though actual protection from light for flint glass as a colour is poor.

For the green bottles, there is a reduction in protection of approximately 15-20% between the lightweighted and standard weight bottles associated with an approximate 40% reduction in thickness. However, the protection provided by the lightweight bottles is greater than flint bottles.

In conclusion, the results suggest that the use of lightweight bottles for beers currently packaged in standard weight flint and amber bottles will have no negative impact on beer flavour. The situation is less apparent for beers bottled in green glass, as the protection offered by reduced thickness could have an effect on flavour. Therefore, consideration of the effect of light on the beer may need to be taken when lightweighting a green bottle.

**Bottle shape and light**
The amount of light absorbed by a glass bottle is also dependent on the direction of the light and the bottle’s shape. When light shines from above, bottles with a long neck and shallow angled shoulders are best at protecting beers from light strike.

**Solutions**
If lightstrike is a concern, then a number of solutions degrading beers in glass bottles, such as:
- use of filters over in-store lighting;
- use of a UV-screening coatings or sleeves on the bottle; and
- label placement and size to minimise light entry.

**In conclusion**
Beer bottled in glass is affected by light transmission. The level to which this transmission takes place is dependent on glass colour, thickness and to some extent bottle shape. Amber coloured glass is deemed the most effective in preventing light penetration, with flint glass the least effective. In terms of lightweighting, green glass bottles tend to be more susceptible to light transmission as wall thickness decreases.

However, it must not be neglected that even though glass colour and wall thickness can have an impact on the amount of light transmitted through a bottle, many well known beer brands are successfully bottled in green and flint bottles. In some instances, the effect of light on the beer is considered part of the distinct characteristic of some beers.

**Further information**
A more detailed report on glass beer bottles and UV can be downloaded at [www.wrap.org.uk/retail](http://www.wrap.org.uk/retail). Further information on the GlassRite Beer, Cier and Spirits project, packaging optimisation and WRAP can help your brand and business visit [www.wrap.org.uk](http://www.wrap.org.uk).