1 Authentication of orange juice

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1.1 Introduction

1.1.1 Incidence of adulteration

It may be safely assumed that fruit juice falsification is a permanent hazard of commercial life. In 1936, the US Food and Drug Administration (FDA) records orange juice being adulterated with sugar, citric acid, peel flavour and colour (Johnston and Kauffman, 1985), a form of dilution that is still found today. In 1981, a pilot survey by the FDA found minor irregularities in nearly half the orange juice firms inspected, and 3 of 13 companies were using illegal colours or pulp wash (Johnston and Kauffman, 1985). In 1982, the Washington Post was claiming that in one major US city ‘fake juice is so common people don’t remember what real juice tastes like’ (Mitchell, 1982). The size of the problem is always unclear, but informed sources in 1983 were suggesting that up to 30% of the juice in the United States was adulterated to some degree, despite official assurances to the contrary. The feeling seems to be that this has since fallen to around 10%. There is some disagreement about the value of the US orange juice market, put at $3800 × 10^6 in 1983 by Nikdel and Nagy (1985) and, more conservatively, at about $2000 × 10^6 in 1987 (Doner et al., 1987), but the economic value of juice adulteration is substantial.

At the time of writing, some Western European countries appear to be suffering a much greater incidence of falsified orange juice than the United States. This has led to suggestions in the press of large-scale fraud (Jones, 1988) and the allegation that ‘Britain has become a bucket shop for fake orange juice’ (Butler, 1988a).

The problem is, of course, not exclusively Britain’s or the United States’, but can affect any importing country, especially when times of shortage match bouyant demand—the situation in 1987/1988, for example.

The economic aspect of juice falsification is the principal reason for consumer concern over the practice. Juice adulteration seldom carries any risk to health. Although there is usually some decline in flavour quality involved, this can be less than that due to clumsy processing of genuine product. Nevertheless, passing off an assortment of cheap materials such as sugars, acid and colour as a costly and prized fruit juice is deceitful.
Consumers rightly expect that foods are correctly described, and deserve the best efforts of reputable suppliers and enforcement authorities to ensure that this is so. We should also be clear that our concern here is juice falsification and not contamination. The latter, whether deliberate or accidental, is the inclusion of foreign materials, often harmful to health. Juice adulteration is normally a deliberate act of attempted fraud. Although the materials employed may be foreign to the juice, they are increasingly so like the juice that they cannot be regarded as contaminants in the classical sense.

The discussion here relates to orange juice, particularly (but not exclusively) to frozen concentrated orange juice (FCOJ). This is the single largest juice product in international trade, and generally the focus of most concern. Locally, other juices may attract almost as much attention, for example apple juice in the United States. However, while most has been published on orange juice, many of the principles of detection are applicable to other juices. To assist the reader, the reference section is divided into those sources directly referred to in the text and a separate group of references, mostly for information on other juices.

1.1.2 The market for frozen concentrated orange juice

A brief picture is given here, as it illustrates the background to the literature. The world’s biggest market for FCOJ is the United States at around $5 \times 10^6$ tonnes of concentrate. The largest FCOJ producing state is Florida. This normally satisfies about half the domestic demand, although this is expected to be up to 70% for 1988 in a bumper harvest (Butler, 1988d). The United States imports FCOJ, typically $2.7 \times 10^6$ tonnes per year between 1984 and 1986, 90% of which comes from Brazil, with Mexico the next most important source and accounting for 6% of US imports in 1986.

After the United States, Western Europe is the second largest user of FCOJ. Orange accounts for 60% of all Western European consumption of juice and juice-based drinks. More than 65% of all single strength juice sales in the United Kingdom are orange juice. The most significant importers in Europe are Germany, followed by the United Kingdom and France, in a total market of 420,000 tonnes a year for 1984–1987 (Butler, 1987). Europe is also a producer of orange juice, responsible for 18% of world output, with Italy and Spain the major sources. However, European demand for orange juice has grown to such an extent that, to be self-sufficient, almost all the European orange crop would have to be juiced.

Table 1.1 shows the sources of imports to the three largest European markets. In world terms, the key juice suppliers are, for the United States, Florida and Brazil, and for Europe, Brazil followed by Israel. It should be remembered that intra-European sources such as Belgium and the Netherlands actually buy mostly Brazilian and Israeli juice for resale.