Detoxification of Foods in Food Processing

B. J. F. Hudson

Department of Food Science, University of Reading, Reading, UK

ABSTRACT

Food processing embraces a very wide range of operations, varying from domestic preparation and cooking to sophisticated techniques for heating, freezing, sterilisation, fractionation and so on.

Many well-accepted traditional foods contain, as integral components, toxic or anti-nutritional factors, in addition to the possible presence of bacteria, mycotoxins and adventitious contaminants. The object of processing is not only to improve palatability, keeping quality and microbiological safety, but to destroy toxic factors or to minimise their effects.

In food processing, the major objectives are sometimes achieved at the expense of some loss of recognised nutrients. However, in other cases, important nutrients may become available only after appropriate processing, since inhibitors or other interfering compounds may be destroyed or inactivated. Toxic factors can sometimes be destroyed by denaturation, as with enzymes, protease inhibitors and phytohaemagglutinins. They can also be physically removed, for example by leaching, solvent extraction or solid classification methods, as in the removal of gossypol from cottonseed protein, or of phytate from cereals.

Two currently important examples of the effect of food processing on toxic factors will be examined in detail. Processing of soyabean and similar pulse or oilseed commodities, with a view to food use, is growing, and the quality of the protein in the final product is important. Changes in protein quality at the various stages of processing, as well as the effect on other toxic factors, will be examined. In the case of...
cottonseed protein, the general effect of gossypol on quality has long been known, but the causes have only recently become clear.

Finally, the food processor has the responsibility of ensuring that losses of nutrients are minimal, and that known toxic components are removed or destroyed. He must also appreciate fully the implications of introducing additives or artefacts into processed food. Food additive control, we may hope, is now well organised. However, the unintended appearance of entirely new chemical entities in processed food remains a matter for concern and demands constant vigilance.

INTRODUCTION

Food processing includes a wide range of operations, from post-harvest storage, which can be regarded as prolonged processing under more or less controlled conditions of temperature and humidity, to domestic cooking, which can involve a wide variety of environmental conditions and provides an opportunity for many complex chemical changes and interactions to take place. In between these 'first and last' forms of processing comes industrial processing which will have as its objectives improvement of palatability, or shelf-life and safety, and occasionally of nutritive value. In the production of 'fabricated foods' it will also have the object of supplying the consumer with items he is unable or unwilling to prepare under domestic conditions.

It is widely recognised that without the industrial food processor, obtaining the food we demand nowadays would be an uncertain and precarious business. The food processor is able to provide us with hygienically safe, suitably packaged food items of consistent and guaranteed quality and defined shelf-life. In doing so, he inevitably sacrifices nutritional value in some cases, as in vitamin and mineral levels, though these can sometimes be restored and even reinforced by post-processing additions. However, the objectives of processing sometimes include the removal of known toxic factors, so that nutritional value is improved overall. Equally, processing can destroy or deactivate anti-nutritional factors, so that positively useful nutrients, which originally were not fully available, become so as a result. These two aspects are the subject of this paper.

Although food processing is sometimes demonstrably reliable so far as nutritional properties are concerned, it sometimes introduces, through chemical reactions, artefacts that were not present initially.