

this day, exactly as they always were, like an evil genius lurking just beneath the waters, ready enough to swallow up, or otherwise destroy, every ship so unfortunate as to come within its deadly embrace. Perhaps on no part of our coasts were wrecks so common, or attended with such awful loss of life and property, as here on the Goodwin Sands, although latterly this has been very much abated owing to the fact that between Ramsgate and Kingsdown—a distance of about twelve miles—there are now four lifeboat stations, namely, Ramsgate, Deal, Walmer, and Kingsdown. A bright look-out is always kept at all these places, and therefore the moment a signal-gun is heard from one or other of the four lightships at the Gull Stream, the North Sands Head, the East Goodwin, or the South Sands Head, or a rocket or burning tar-barrel is seen exhibited by a ship in distress, a score of brave and willing hearts are instantly ready to man either of these life-boats, and fly to the assistance of their perishing fellow-creatures, generally with the most happy results, for the circumstance of a lifeboat failing in its endeavours is rare indeed. Great must be the sea and terrific the tempest that interfere with the work of one of these boats. Repeated instances are on record where a boat's crew has been out for periods of twelve and sixteen hours at a time, with neither food nor drink, drenched with spray, and perhaps half frozen besides, hovering round a stranded ship, making the most desperate efforts to rescue the suffering crew clinging convulsively to the rigging, a frail support that at any moment may give way beneath their feet and engulf the whole in the boiling surge. Again and again, through the pitchy darkness and the roaring breakers, does the boat and her brave, intrepid crew "advance to the charge;" again and again to be beaten back by the irresistible power of winds and waves, sometimes indeed to be even capsized and her crew thrown out, but somehow or other, thanks to

their cork-jackets and life-lines, to manage to scramble on board again, whilst the boat immediately rights herself, and as quickly discharges the water she has shipped through her relieving valves, by which admirable invention the boat is kept clear of water without the tedious operation of baling. Thus, in the terrible battle with two of the mightiest elements, will these "storm warriors"—as they have been so aptly called by Mr. Gilmore—carry on the unequal strife, never leaving the suffering crew until they have rescued all, or haply—as sometimes happens—the wreck suddenly breaks up, and the whole are instantly buried beneath the angry sea. And even then, when hope itself has fled, the lifeboat men, instead of at once steering homewards, will keep about the spot for a time, and may at last, perhaps, succeed in rescuing some exhausted sailor clinging to a broken spar, or even may pick up a lifeless corpse, which, when recovered, is carefully laid down in the boat and reverently covered over with a sail, and when brought ashore is accorded the rites of Christian burial.

And thus the seeker after health and repose, if he cares to select this picturesque spot for his annual holiday, and if he has the industry to seek, and the mind to comprehend, will find much that is very attractive, not only to the artist, but especially to the archæologist, and deeply interesting to the man of general intelligence as well. And besides all this—if he chooses so to do—he may find a never-ending source of amusement, and possibly instruction combined, if he has any feeling for heroism, or admiration for noble disinterested bravery, which he will meet with in the stories of rescue from the Goodwin Sands, not only by lifeboat crews, but by hovellers' boats as well, so that in the end he may possibly find that the time was neither lost nor altogether unprofitable which he may have passed in this corner of Kent, when taking his ease, and enjoying his rest and relaxation "on the beach."

G. G.



## ADULTERATION, AND HOW TO DETECT IT.

BY AN ANALYST.



WE are apt to think our own times worse than any that have gone before, and to fancy that in our forefathers' days men dealt fairly with each other, and conducted their business in an honest and upright fashion. A perusal of the old laws of our land will put us right on that score; for if we are to infer that the existence of laws indicates the co-existence of forms of evil against which these laws are directed, we find that adulteration is no birth of yesterday, but that so long ago as the reign of

Henry III. it occupied the attention of our law-makers. At that time wine was the general alcoholic drink, and thus early some money-making wine merchant had discovered how to sophisticate his liquors with various coloured decoctions. The practice soon spread to such an extent as to necessitate an enactment forbidding the sale to His Majesty's subjects of any such wine; and this law also forbade the sale of unwholesome meat, which then appears to have been prevalent.

We find the adulteration of wine again cropping up in the reign of Charles II., in whose time its use was almost universal, for we find that claret was largely consumed at fairs, where now malt liquors, beer, and



whiskey are almost the sole alcoholics in popular favour. From time to time various Acts were passed prohibiting the adulteration of beer, tea, coffee, &c. ; and later on, in the reign of George IV., the use of alum in bread-making was made punishable by a fine of £20 or twelve months' imprisonment.

These Acts were all fragmentary, dealing only with a few articles, and it was only in 1860 that adulteration as a whole was first taken up, and the subject properly grappled with. In this year the first general adulteration Act was passed, the necessity for which had been shown by Dr. Hassall's investigations as chief of a medical commission, the state of business having become such that it was next to impossible to obtain—in London at least—such a thing as a pure loaf or a quart of genuine milk.

For a short time this Act of 1860 acted as a deterrent on adulterators, but soon through many defects in its machinery it proved a dead letter, and things went on worse than before. But a climax was reached, and in 1872 a new Act drew the reins so tightly on the adulterating manufacturers and dealers that they got up a great agitation on the subject, and such was their influence that they obtained a select committee of the House of Commons to consider the question. The arguments of the nation of shopkeepers, lame though they might appear from a customer's point of view, resulted in the committee recommending milder measures than those in force, and in 1875 the "Sale of Food and Drugs Act" was accordingly passed.

Defective on many points, as we must lament, it has proved of great value, as shown by the different condition of trade morality now prevalent. The investigations of Dr. Hassall showed about 65 per cent. of all the samples he examined to be adulterated, whilst 14,383 samples examined by the Society of Public Analysts in 1872-3 gave an average of only 26 per cent. adulterated, and in 1875 this figure was reduced to 12 per cent.

Yet, notwithstanding the improved state of affairs, a great amount of adulteration still goes on, else where were the need for so many officers of health and public analysts? And we would draw attention to a few simple tests not generally known for readily obtaining a good idea as to the genuineness of various articles of common use, without the necessity for delicate apparatus or expensive chemicals.

#### *Water.*

Water should be clear and sparkling, and with little or no taste. For all purposes soft should be preferred to hard, and a water which gives a large deposit on boiling should be avoided if possible. But the mineral matter dissolved in water is of much less importance than the organic, which has been proved to be the fruitful source of many kinds of zymotic diseases—scarlatina, small-pox, typhus, &c.

A good and simple test is as follows:—A two or three ounce wide-mouthed and stoppered bottle is almost filled with the water to be tested ; a piece of loaf sugar is added, and the bottle tightly stoppered

is allowed to stand in the light for a day or two. If the water be free from organic pollution, it will generally remain quite clear ; but if bad, a milky cloud will be produced, more or less apparent according to the quality of the water. This milkiness is due chiefly to the presence of phosphates, which are always found in sewage, and thus indicates the probable admixture of sewage with the water.

#### *Tea.*

"The cup that cheers, but not inebriates," has passed into a household word, but with almost equal truth might we employ the phrase, "There's poison in the cup." There is, perhaps, no article of domestic consumption so commonly mixed with deleterious or worthless ingredients as this same Eastern leaf, a condition of things probably due to the demand being greater than the supply. The most common adulterants of tea are exhausted tea-leaves, leaves of other plants, lie-tea, sand, and the various materials used for facing or colouring the leaf.

The practice of re-drying used tea-leaves is confined to this country, where in 1843 there were about a dozen manufactories, mostly in the large towns, where persons were employed to buy up the exhausted leaves at hotels, coffee-houses, &c., at merely nominal prices. This system is still carried on, though on a diminished scale. The leaves are re-dried to a certain extent, then rinsed with a solution of gum and coppers, rolled into shape and completely dried, being afterwards mixed with black-lead to "face" them. Leaves thus doctored are, however, not very difficult of detection, for the gum causes them to present a glossy appearance, and the fold of the leaf is less regular than in the genuine article.

The addition of leaves other than of the tea-plant may be readily detected by spreading out a few of the leaves from the bottom of a tea-pot. There should be no difficulty in picking out a few genuine leaves, the lanceolate, spearhead-like shape of which, together with the serration on the edge of the leaf, should be sufficient to distinguish the tea-leaf from that of any other plant used to counterfeit it.

Lie-tea consists of the dust and sweepings of tea factories, neatly cemented with a solution of starch, and moulded with the fingers to resemble the ordinary leaf, although to a careful observer the difference is readily apparent, and any doubt is removed by pouring some boiling water over the tea, when if genuine it will merely soften and open out, but if lie-tea it will all break up into a dirty sediment ; and if sand has been added or introduced with the sweepings, its presence is detected by the grittiness felt by chewing a little of the tea between the teeth. The facing used for tea usually consists of Prussian blue or indigo, the presence of which can only be revealed by chemical tests ; but if magnetic oxide of iron has been employed, it may be discovered by means of a magnet, to which the particles will adhere. Green teas are those most frequently adulterated, black tea (especially of Indian growth) being on the whole of a reliably genuine character.



*Coffee.*

This is a substance which in the ground state affords a field for adulteration which very few merchants have failed to take advantage of, and for this purpose chicory, carrots, caramel, date-seeds, &c., are the substances most commonly used. The beans have of late years been skilfully imitated, but as coffee is mostly purchased in the ground condition, the chief point for the consumer is to be able to form some idea as to the character of the latter article, and the following are a few simple and reliable tests for its genuineness:—

Take a little of the coffee and press it between the fingers, or give it a squeeze in the paper in which it is bought: if genuine, it will *not* form a coherent mass, as coffee grains are hard, and do not readily adhere to each other; but if the grains stick to each other and form a sort of "cake," we may be pretty sure of adulteration in the shape of chicory, for the grains of chicory are softer and more open, and adhere without difficulty when squeezed.

Again, if we place a few grains in a saucer and moisten them with a little cold water, chicory will very quickly become soft like bread-crumbs, while coffee will take a long time to soften.

A third test: take a wine-glass or a tumbler full of water and gently drop a pinch of the ground coffee on the surface of the water without stirring or agitating: genuine coffee will float for some time, whilst chicory or any other sweet root will soon sink; and chicory or caramel will cause a yellowish or brownish colour to diffuse rapidly through the water, while pure coffee will give no sensible tint under such circumstances for a considerable length of time.

"Coffee mixtures" or "coffee improvers" should be avoided. They seldom consist of anything but chicory and caramel (burnt sugar), which, of course, deceive by the rich, dark infusion they give.

"French coffee," so widely used at present, is generally ground coffee, the beans of which have been roasted with a certain amount of sugar, which coating over the bean has retained more of the original aroma than in ordinary coffee, but this, of course, at the expense of the reduced percentage of coffee due to the presence of the caramelised sugar.

*Confections.*

Of late years the cheapness of sugar has so enormously extended the use of the better qualities, that bad or adulterated sugar is now almost unknown; but in the shape of confectionery and sweets, the pure and genuine article is hard to find. To make them attractive to children most of them are highly coloured with various mineral or vegetable substances, the

greater part of which are deadly poisons. Yellow is produced by chromate of lead; red by cochineal, red-lead, vermilion, &c.; brown by umber, sienna, &c.; purple by Prussian blue; blue by indigo, ultramarine, or Prussian blue; and the greens, most deadly of all, by Brunswick green, verdigris, and Scheele's green—an arsenite of copper.

There is unfortunately no ready method of detecting these poisons without chemical tests, but as adulterated sweets are seldom free from chalk, gypsum, flour, starch, &c., two simple tests give us a fair idea of their character. Pure sweets should consist entirely of sugar, some of course containing a few grains of ginger, &c., otherwise they should be completely soluble in water, the above materials, chalk, &c., being insoluble. Again, if a piece of the sweet is held over a clear fire—on a shovel or anything else that may be handy—until all blackness has disappeared, only a small quantity of ash should be left if prepared from pure sugar, but if chalk, lime, or clay has been added, a large amount of ash will be left, and the original shape of the sweet will probably be retained.

*Pickles.*

The chief adulterant of pickles is acetate of copper—a violent poison, as are all salts of copper—the object of its use being to impart a bright green colour to the pickles. Happily the detection of copper in acid liquids is simple and reliable. Take a little of the liquid in which the pickles are preserved and place it in a small glass tube, a flower-glass, wine-glass, or anything else convenient; insert the end of a bright knitting-wire or other article of polished steel—a knife-blade, for instance—into the liquid, and let it stand a short time. A red deposit or coating on the steel in greater or less quantity proves the presence of copper, and the danger there may be in the use of the pickles.

We might go on in like manner with many an article of every-day use, but our purpose has been to refer only to the adulteration of the most important articles of food, and we have sought to show that, although for the exact detection and estimation of adulterants it may require a skilled analyst and properly appointed laboratory, yet there are many simple and sufficient tests of the genuineness of the foods we use, which may be employed by any one at little or no expense, and without the necessity either of a microscope or of dangerous and expensive chemicals. We need not add that the fact should be fully and thankfully recognised that the great majority of manufacturers and dealers—especially the most eminent—are far above suspicion in respect of adulteration or any other "tricks of trade."

J. G.

