INDIGO (Gr. Índikon, Indian), a most important vegetable dyestuff, yielding a beautiful blue and very durable dye, the basis also of the best black dye in woollen cloths. It has been used in India from a very early period, and was imported thence by the ancient Greeks and Romans, but was lost to Europe during great part of the Middle Ages—although the cultivation of the plant and preparation of the dye were described by Marco Polo in the 13th C.—until re-introduced by the Dutch about the middle of the 16th century. Its use in England, France, and Saxony was then for a considerable time
INDIGO.

prevented by a strong prejudice against it, arising from the difficulty experienced in fixing the colour.

Since this has been overcome, the cultivation of plants producing indigo, long confined to India, has extended to many other tropical and subtropical countries, as Egypt, the West Indies, Mexico, Brazil, &c. These plants generally belong to the genus Indigofera, of the natural order Leguminosce, sub-order Papilionaceae. The top of the corolla is furnished with both sides with an awl-shaped spur. The species of this genus, number at least 150, and are natives of almost all tropical and subtropical countries. Of these, I. tinctoria is the species most generally cultivated in India. It is a half-hardy plant, 2—3 feet high, with pinnae leaves, which have five or six pairs of long-obovate, dull, bluish-green leaflets, and racemes of auxiliary pale red flowers.

The province of Tinevally produces a great quantity of indigo. Bengal produces, on an average, about nine millions of pounds annually. The sum which is paid for indigo is estimated at eight or ten millions of pounds sterling.

Indigo is, however, obtained from plants of other genera, particularly from Wrightia tinctoria (natural order Leguminosce), East Indies; Baptisia tinctoria (natural order Leguminosce), North America, which yields indigo of a pale colour and very inferior quality; Pachyrrhiza tinctoria (natural order Leguminosce), Malabar; and T. Aphelaea, Egypt and Nubia; Maranta tinctoria (natural order Asclepiadaceae), in Sylhet; and Polygonum tinctorum and P. Chinense (natural order Polygonaceae), China and Japan. Wrightia tinctoria is a large shrub, indigenous to great part of India and to Ceylon, yielding indigo of the finest quality, and is recommended by Dr. Roxburgh for cultivation, as less dependent than the common indigo plants on rain and irrigation. It grows very freely, and throws out shoots rapidly on their being cut away. In times when East Indian indigo was not known, or was brought to Europe only in small quantity, the same dyestuff was obtained from Woad (q. v.).—A coarse kind of indigo, called Bastard Indigo, was also at one time made in North America from the young shoots of Amorpha aurea.

The Manufacture and Applications of Indigo.

The indigo plant, in its general appearance, is not unlike the lucerne of our fields. The seed is sown in drills about 10 inches apart, and soon makes its appearance above ground, when it requires incessant care to keep the weeds down, which otherwise would soon choke it to death. In about three months, the plants begin to flower, and are then cut down, but soon shoot up again, and yield a second cutting, sometimes a third, the same year. Formerly, indigo was carefully dried after being cut, and even fire-heat was sometimes used for the purpose, but now—at least in India—the practice is abandoned, and it is found in every respect better to use the plant whilst fresh and green. The first process is to pack a large vat full of the freshly cut indigo; heavy wooden beams are placed on the top to press it and fix it down; and water is then let into the vat, enough just to cover it. Being left in this state for from ten to twelve hours, fermentation is set up, and much gas disgorged, the water becoming a light-green colour. The green liquid is then run off into the second vat, which is placed below the level of the first, in which, whilst the fermentation process is being repeated upon a fresh supply in the first vat, it is violently agitated by being beaten with poles; this causes the grains, as it is called, to separate, and the green matter suspended in the liquor becomes blue and granular.

When this operation is sufficiently advanced, the contents of the vat are allowed to settle, and the sediment is then run into the third vat, which is below the level of the second, from which it is pumped into a boiler. The boiler is slightly heated, and then allowed to stand for a few hours, during which time the indigo settles down, and as much clear water as possible is drawn off from above it. The boiler is then again heated, and this time up to the boiling-point; after which its contents are allowed to run on to a frame of wood, lined with 'long-cloth' sheeting, where they remain to drain till about the consistence of very thick cream, when they are removed, and subjected to very heavy screw pressure; and when as hard and dry as ordinary soap, are cut by brass wire on a frame into cubes about three inches square; and these are laid out, so as not to touch each other, on the shelves of the drying-house. Finally, the cakes are cleaned, one by one, and tightly packed in boxes for the market.

This dye is, without doubt, the oldest in use; the Greeks and Romans obtain a very strong yellow from India, where its employment has been very general for a great length of time. Much obscurity involves indigo and its early use, in consequence of the variation in its name. In Sanscrit, the plant is called Naudum; in Sanscrit, the plant is called Naudum; and the latter name is often used for the Amal of the Portuguese. The Malays call the dye Turkos, and the Arabs, Noul.

Commercially speaking, indigo may be said to be the produce of India and Central America, as these are the only localities which supply the recognised form of the article. In India, the chief seat of the indigo manufacture, Bengal is the most important district. The total quantity received in Great Britain in 1876 was upwards of 88,000 cwt.—a vast quantity, when it is borne in mind with what difficulty it is cultivated and manufactured. When pure, indigo has a rich, dark-blue color, almost purple; it is in small cubes or parts of cubes, and its fracture shows a tendency to break up into square pieces, and indicates cracks in its substance, often filled up with a film of whitish efflorescence, probably the lime used in precipitating it. It has neither taste nor smell, and its specific gravity is about 1·20; if rubbed with any hard substance, it gives a streak with a bright coppery lustre. The varieties recognised in commerce are—1st. Bengal, which, from the care taken in its preparation, and the large scale on which it is made in that district, is the best; and its various gradations of quality, ten in number, from 9s. to 15s. per pound, are always kept distinct. In other sorts, they are usually much mixed. 2d. Madras and Kurrat; 3d. Odile; 4th. Manila; 5th. Java; and 5th. South American. The last is packed in serons or cases of dried ox-skin, and its qualities are distinguished as follows: 1st. Flores; 2d. Sobres; and 3d. Cortes; all the others are in wooden chests, containing about 250 lbs. each.

Few materials are of greater importance to the dyer than indigo, and none require the exercise of more care and skill in using. Having in mind the nature of the water, it requires the action of other solvents to render it capable of penetrating the fibres of the materials to be dyed. The method generally employed is the following: The indigo is ground into small lumps, and these are soaked in hot water, and left for at least 48 hours, in order that the moisture may soak through and into the material; after which they are put into the indigo-mill, which is a levigating machine, consisting of a vessel in which a roller is made to work by machinery, so as to rub down the indigo, mixed with plenty of water, to a very
of man, the horse, and the cow, and occasionally in
the milk of the cow, when these fluids have been ex-
posed for some time to the action of the air; but
Schunck obtained it from the urine in so many cases
(of the urine of 39 persons out of 40), that Indican
(or the chromogen yielding indigo blue) must be
regarded as a normal urinary constituent. See M.
Schunck's paper in The Memoirs of the Literary and
Philosophical Society of Manchester, 1837, vol. xiv.,
or Day's Chemistry in its Relations to Physiology and
Medicine, 1860, pp. 310—312.

Indigo White or Reduced Indigo, in a state of
purity, occurs in white flakes, which are devoid of
taste or smell, are perfectly neutral, and are
insoluble in water, but dissolve in alcohol, ether,
and alkaline solutions. Its composition is repre-
sented by the formula $C_9H_7NO_3$, and as it only
differs from indigo blue, $C_9H_7NO_3$, in containing
one more equivalent of $H$, it may be considered as
the hydride of the latter. If yarn or woven goods
be immered in an alkaline solution of this sub-
stance till they are thoroughly saturated, and are
then exposed to the air, indigo blue is formed
within the fibres of the tissue. The blue dye thus
obtained is very intense and permanent. From its
property of becoming blue on exposure to the air,
indigo white is a sensitive test for the presence of
free oxygen.

Many compounds of great chemical interest have
been derived from indigo blue. It was from
indigo that usimine (now so largely employed in the
production of the pigments known as mauve and
magenta) was first obtained.