GAODENG XUEXIAO ZHUANYE JIAOCAI

· 高等学校专业教材 ·

制糖工程专业英语

陆冬梅 主编

PROFESSIONAL ENGLISH FOR SUGAR ENGINEERING

中国轻工业出版社

高等学校专业教材

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前 言

制糖业是以甘蔗或甜菜等农作物为原料，生产原糖和成品食糖及对食糖进行精加工的工业行业，也是高度机械化、连续化的现代化工业生产，它的生产过程几乎包括了所有主要的化工单元，是具有综合化工单元生产过程的食品生产行业，在国民经济中占有重要地位。我国 2007/2008 榨季食糖产量位居世界第三，食糖消费量达到 1350 万 t，位居世界第二。但我国的人均食糖消费量却很低，还不到世界人均水平的二分之一，市场发展空间巨大。近年来，由于国内糖价一直处于较高水平，农民种植甘蔗和甜菜的热情高涨，刺激国内制糖企业规模不断扩大，并促进企业提高新设备及新技术的应用积极性。

随着制糖工业的科技要求及工艺指标要求的不断提高，对制糖装备的要求也越来越高。世界各国都十分重视糖业的发展，尤其是先进的产糖大国投入大量的资金，不断开发新技术。我国制糖工业基础薄弱，技术投入不足，生产技术水平及装备水平与发达国家相比，还有一定差距，特别是在规模化生产、装备开发和自动化水平方面差距较大。为提高国内制糖企业在国际上的竞争力，企业对制糖行业人才的需求除了必须掌握传统的工艺和设备基础知识之外，还要求具有通过英文文献获取和共享信息资源的能力，以及与国外同行进行交流的能力。

目前国内一些高等院校开设了制糖工程专业，但毕业生进入制糖企业时，最大的困难是缺乏制糖专业英语词汇、术语，对设备及工艺流程的英文表达了解也不多，而且国内迄今为止尚未有相关的教材出版。在这样的背景下，编写《制糖工程专业英语》及开设制糖工程专业英语课程，使学生熟悉本专业的基本科技词汇，掌握科技英语写作的一般规范，并能够借助辞典阅读专业科技文献，能够用英语表述专业概念，书写科技文章的摘要等。这些对融会学习本专业课程的知识，提高综合应用专业知识的能力及满足企业对高层次人才的需要具有重要意义。

本教材素材来源于原版英文《制糖过程》，由 9 个单元（Unit）32 课（Lesson）构成，每课由课文、词汇表、课后练习、参考译文组成。课文主要内容有制糖所用原料及成分、提汁过程、亚硫酸法澄清及碳酸法澄清、糖汁蒸发、蔗糖结晶、助晶工艺及设备、糖膏的离心分蜜、废蜜的性质及贮藏、制糖副产品及深加工。每课之间，既有一定的内在联系，又独立成章，可根据不同学时数灵活选用。书后附有词汇总表、英文常用词头、常用英文缩写与符号以及制糖杂志与期刊以供查阅。

本教材内容语言精炼、知识性强、覆盖面广、难度适中，可供理工类本科制糖工程专业三四年级学生使用，也可供同等英语程度轻工食品行业或相关领域的科技人员

使用。

本教材在编写过程中参阅了大量科技英语和专业方面的书刊，限于编者水平有限，书中难免会有不足之处，恳请广大读者指正，编者不胜感谢。

编　者

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Sugarcane

Sugarcane, with its high **fibre** and **carbohydrate** content constitutes an important renewable source of energy. During its long growth period of 10 to 16 months this plant converts good amount of solar energy into sugar and **cellulose** and is considered to be one of the most energy efficient crops in that the energy provided by the **biomass** of fully grown cane is four times the energy input during the crop cultivation. Sugarcane sets are planted in soil and the plant develops growth in the course of its life cycle, during which it converts water and CO_2 from atmosphere into carbohydrates in the presence of sunshine, a phenomenon termed as **photosynthesis**.

In the growth phase of the plant, sugar accumulation occurs more in the lower portion of the stalk, progressively decreasing from bottom to top **joints** but in a fully mature cane this disparity is practically absent or negligible. Within the **stalk** the **internodes** are richer in sugar while the fibre content is higher in the **nodes** as shown by the earlier studies on variation in composition of these portions: cane with short internodes will give high fibre and lower sugar content, the juice expressed in the last mill under heavy pressure is of lower purity than the first or second mill .

Sugar cane plant standing in the field consists of three principal portions: the **leaves**, the **tops**, and the stalk. The tops and leaves contain very low **sugars** but are rich in salts in solution as well as water. The sugarcane stalks delivered to the factories have to be free from the tops and

roots and as such during harvesting, care is taken to remove them so that the sugar rich portions of the plant are processed. The principal components of the cane stalks to be processed for commercial sugar production, are around 70 – 75% water, 12 – 15% water insoluble fibre and sucrose and other carbohydrates.

Besides these the composition of juice extracted from cane is marked by varying amounts of mineral salts and organic compounds. The composition of sugarcane is conditioned by the variety of cane, soils and agricultural factors in addition to the climate during the different phases of growth of the plant. At the end of its growth period, the sugarcane crop reaches maturity, during dry weather, marked by highest sugar build up, when it is considered to be suitable for harvesting. If allowed to stand in the field after its **maturity phase**, it starts deteriorating in the sense that sucrose gets decomposed with the formation of non – sucrose compounds and cellulose. The **overmature** cane will thus build up higher fibre with reduced sugar content and it is absolutely essential for the processing factories to harvest the cane after it attains full maturity.

Sugars in general are known as carbohydrates being formed of carbon, hydrogen and oxygen. Simple sugars like glucose, **fructose** etc. are **monosaccharides** which cannot be further decomposed into simple carbohydrates by either **acids** or **enzymes**. When composed of five carbon atoms these carbohydrates like **arabinose** are termed as **pentoses**. Likewise sugars like glucose, fructose containing six carbon atoms are known as **hexoses**. Monosaccharides condense together to form **disaccharides** or even **trisaccharides** containing two or three monosaccharides. Sucrose, **maltose** and **lactose** belong to the category of disaccharide which under influence of acid or enzyme form simple monosaccharides. Sucrose is the condensation product of glucose and **levulose** or fructose, the first being an **aldehyde** while the latter contains **ketone** group. Several **polysaccharides** produced by condensation of monosaccharides, are present in sugarcane like **gums**, **dextran**, **starch**, cellulose, which when reacted by acids or enzymes are converted to monosaccharides.

Words and Expressions

sugarcane ['ʃugəˌkein] *n.* <植>甘蔗

fibre ['faibə] *n.* 1. (动植物的) 纤维; 2. 纤维质

carbohydrate [ˌkɑ:bəu'haidreit] *n.* 1. 碳水化合物, 糖类; 2. 淀粉质或糖类食物

cellulose ['seljələus] *n.* 细胞膜质; 纤维素

biomass ['baiəumæs] *n.* (单位面积或体积内) 生物的数量

photosynthesis [ˌfəutəu'sinθəsis] *n.* 光合作用, 光能合成

stalk [stɔ:k] *n.* 主茎, 花梗, 叶柄

joint [dʒɔint] *n.* 1. 关节; 2. 接头, 接合处

internode ['intənəud] *n.* 1. 节间; 2. 节间部

node [nəud] *n.* 1. 节, 瘤; 2. 结节; 3. 植物的节; 4. (计算机网络的) 节点

leaves [li:vz] *n.* 树叶, 花瓣

top [tɔp] *n.* 顶部，顶端

sugar ['ʃugə] *n.* 1. 糖；2. 一块［茶匙等］糖
vt. 1. 在……加糖；2. 给……裹上（糖衣或类糖物）

maturity phase 壮年期

overmature [ˌəuvəmə'tjuə] *adj.* 过熟的（果实）

fructose ['frʌktəus] *n.* 果糖

monosaccharide [ˌmɔnəu'sækəraid] *n.* 单糖

acid ['æsid] *adj.* 1. 酸味的，酸的；2. 尖刻的
n. 1. <化>酸；2. 酸味物质

enzyme ['enzaim] *n.* <生化>酶

arabinose [ə'ræbənəus] *n.* 阿拉伯糖

pentose ['pentəus] *n.* 戊糖

hexose ['heksəus] *n.* 己糖

disaccharide [dai'sækəraid] *n.* 二糖

trisaccharide [trai'sækəraid] *n.* 三糖

maltose ['mɔ:ltəus] *n.* 麦芽糖

lactose ['læktəus] *n.* 乳糖

levulose ['levjuləus] *n.* 果糖

aldehyde ['ældihaid] *n.* 醛，乙醛

ketone ['ki:təun] *n.* 酮

polysaccharide ['pɔli 'sækəraid] *n.* 多糖

gum [gʌm] *n.* 树胶

dextran ['dekstrən] *n.* 右旋糖苷

starch [stɑ:tʃ] *n.* 1. 淀粉；2. 含淀粉的食物；3. 浆粉

Exercises

1. After reading the text above, summarize the main idea of it in oral English.
2. Answer the following questions according to the text.
(1) What is photosynthesis?
(2) which part of sugar cane is richer in sugar?
(3) It is absolutely essential to harvest the cane after it attains full maturity, why?
3. Put the following into English.
甘蔗　蔗节　蔗梢　多糖　糊精　淀粉　单糖　双糖
4. Fill in the blanks with proper words.
Besides these the composition of juice extracted from cane is marked by varying amounts of _____ and _____ compounds. The composition of sugarcane is conditioned by the variety of cane, soils and agricultural factors in addition to the climate during the different

phases of growth of the plant. At the end of its growth period, the sugarcane crop reaches _____ _____, during dry weather, marked by _____ sugar build up, when it is considered to be suitable for _____. If allowed to stand in the field after its maturity phase, it starts deteriorating in the sense that sucrose gets _____ with the formation of _____ compounds and _____. The overmature cane will thus build up higher fibre with reduced sugar content and it is absolutely essential for the processing factories to harvest the cane after it attains full maturity.

5. Translate the following into Chinese.

Sugars in general are known as carbohydrates being formed of carbon, hydrogen and oxygen. Simple sugars like glucose, fructose etc. are monosaccharides which cannot be further decomposed into simple carbohydrates by either acids or enzymes. When composed of five carbon atoms these carbohydrates like arabinose are termed as pentoses. Likewise sugars like glucose, fructose containing six carbon atoms are known as hexoses. Monosaccharides condense together to form disaccharides or even trisaccharides containing two or three monosaccharides. Sucrose, maltose and lactose belong to the category of disaccharide which under influence of acid or enzyme form simple monosaccharides. Sucrose is the condensation product of glucose and levulose or fructose, the first being an aldehyde while the latter contains ketone group. Several polysaccharides produced by condensation of monosaccharides, are present in sugarcane like gums, dextran, starch, cellulose, which when reacted by acids or enzymes are converted to monosaccharides.

参考译文

甘　蔗

甘蔗的高纤维分和碳水化合物含量是可再生能源的重要来源，这种植物在长达 10 ~ 16 个月的生长期内能够把大量光能转化成糖和纤维素。由于甘蔗在其整个生长阶段的代谢活动中可以提供比吸收高 4 倍的能量，因此被认为是最具效能的作物之一。甘蔗种植在土壤里，在其生命周期中不断成长，并将水和从大气中吸收的二氧化碳通过光照作用转变成碳水化合物，这种现象称为光合作用。

在植物的生长阶段，糖分大多数积蓄在蔗茎下部，从底部到顶部逐渐减少，但对于完全成熟的甘蔗，这种差异实际上是不存在或可忽略不计的。早期对甘蔗不同部分成分变化的研究表明整个蔗茎中节间含糖量最多，蔗节纤维含量则较高。节间较短的甘蔗纤维含量高且蔗糖含量较低，因此高压下从末效压榨机提取出来的蔗汁纯度要低于第一或第二压榨机的蔗汁纯度。

种植在田地里的甘蔗由三个主要部分组成：蔗叶、蔗梢和蔗茎。蔗梢和蔗叶含糖量非常低，但盐和水分含量很丰富。送到糖厂的蔗茎在收割时必须去除蔗梢和蔗根，去除蔗梢和蔗根时要小心，务必使富含蔗糖的部分能保留下来。用于生产商业蔗糖产品的蔗茎主要成分是 70% ~75% 水、12% ~15% 水不溶性纤维和蔗糖以及其它碳水化合物。

除了上述成分，从甘蔗中提取出来的蔗汁还含有不同量的矿物盐和有机物。上述成分与甘蔗的品种、土壤、农业因素以及植物生长中不同阶段的气候条件都有关系。在生长末期，在干燥的天气条件下甘蔗中的含糖量达到最高则表明甘蔗已经成熟，此时被认为最适合收割。如果任由甘蔗在田地里生长超过成熟阶段，从某种意义来说，甘蔗的质量已经开始恶化，即蔗糖开始分解，非糖化合物和纤维素形成，这使得过于成熟的甘蔗具有很高的纤维分和还原糖量。因此对于糖厂来说，及时收割已经完全成熟的甘蔗是绝对必要的。

众所周知，糖由碳、氢、氧构成，因此被称为碳水化合物。简单的糖，如葡萄糖、果糖等单糖不能用酸或酶进一步分解成单碳水化合物。由 5 个碳原子组成的碳水化合物如阿拉伯糖被称为戊糖。同样如葡萄糖、果糖含有 6 个碳原子的糖被称为己糖。单糖结合可形成双糖甚至三糖，即包含两个或三个单糖。蔗糖、麦芽糖和乳糖属于双糖，在酸或酶的作用下可形成简单的单糖。蔗糖是葡萄糖和果糖的聚合产物，葡萄糖属于醛糖，果糖属于酮糖。还有一些多糖是由单糖聚合而成的，如树胶、右旋糖酐、淀粉、纤维素，用酸或酶作用可转变成单糖。

Lesson 2

Text

Composition of Cane

Sugarcane fed to **mills** for processing contains besides the water insoluble fibre, sugars, salts and organic matter dissolved in water, some of them being in **colloidal state**. The composition of cane is a function of cultivation practices as also the soil and climatic conditions and is therefore bound to exhibit wide variations from area to area and region to region. Nevertheless the major constituents of sugarcane are sucrose, **reducing sugars**, fibre and salts which exert profound influence on the economic aspects of cane sugar production.

Sucrose, commonly known as cane sugar, is a disaccharide belonging to the family of carbohydrates and is composed of two monosaccharides glucose and fructose condensed together. Sugar solutions are stable under **neutral** conditions of pH and moderate temperatures. They are however, susceptible to microbial action which results in formation of undesirable **fermentation** products at the expense of sugar. The cane juices thus form ideal media for growth of **microorganisms** at atmospheric temperatures. The conditions maintained in the process operations are essentially based on preserving sucrose taking into account the above factors which contribute to decomposition of sucrose due to physical, chemical or microbiological causes. Under the action of acid the sucrose solution is decomposed into **invert sugar** i. e. glucose and fructose, the reaction commonly referred to as **inversion**, which is accelerated by high temperatures. The enzyme invertase also brings about this **hydrolysis** of sucrose at room temperature. The important monosaccharides present in cane juice are glucose and fructose, termed as reducing sugars, these occur in abundance in growing and immature portions of cane but decrease in the lower parts of cane stalk. Immature cane is rich in reducing sugars which decrease as cane reaches maturity but once the maturity phase is crossed they tend to increase. The invert sugar formed by inversion of sucrose shows negative **specific rotation**, on account of higher **levorotatory** activity of fructose over the **dextrorotatory** power of glucose or dextrose. The reducing sugars are sensitive to **alkaline** conditions being decomposed into colouring compounds and organic acids under influence of alkali. They play an important role in determining the final loss of sucrose in the final **molasses**, a waste product of sugar manufacture, in as much as reducing sugars reduce the **solubility** of sucrose in water. Sucrose and reducing

sugars on prolonged heating form brown coloured component known as **caramel**.

The principal **cations** in the mineral matter of cane juice are **potassium**, **calcium**, **magnesium** and **silica** while the anions are **phosphates**, **chlorides**, **sulphates**. The mineral matter content is maximum at the top and growing portions of cane while it tends to reduce in the lower – most internodes of the cane. The mineral constituents and mainly the potassium salts which constitute over 60% of the **total ash** are mainly responsible for the retention of sucrose in the final molasses.

pH of cane – juice is around 5.2 – 5.4 on account of the presence of organic acids, out of which **aconitic acid** forms a major portion, the remaining being citric, **oxalic**, **succinic** as also a number of **amino acids**, prominent amongst whom is **aspartic acid**. Amino acids are found to decrease with advance of maturity but increase again when cane becomes over – mature.

Proteins are present in small amounts and are removed to a considerable extent in **clarification**. The naturally occurring colouring compounds are **chlorophyll**, **carotene** and **xanthophyll** which are removed in process during clarification. However, **polyphenols** contribute to colour formation in process. Among the high molecular weight organic compounds may be mentioned gums, dextran, the latter being the products of microbiological infection of damaged cells of the plant, mainly by the action of **Leuconostoc** while the gums are soluble polysaccharides of the plant. **Deterioration** of sugarcane after harvest results in increase in the amount of dextran and gums. The cane tops are rich in polyphenols and organic acids.

The water insoluble part of cane stalk, commonly known as fibre contains around 40% cellulose, 30% **hemicelluloses** and 15 – 20% **pectin**, with small amount of mineral matter. The cellulosic portion of this fibre has high potential for conversion into commercially valuable products like paper boards etc. This fibrous portion of cane constitutes the main fuel for generation of steam and electric power in sugar plants.

Words and Expressions

mill [mil] *n.* 1. 磨坊，磨粉机；2. 作坊，工厂
colloidal state 胶体状态
reducing sugar 还原（性）糖
neutral ['nju:trəl] *adj.* （化学中）中性的，不带电的
fermentation [ˌfə:men'teiʃən] *n.* 发酵
microorganisms [ˌmaikrəu'ɔ:gənizəm] *n.* 微生物
invert sugar 转化糖
inversion [in'vɜ:ʒən] *n.* 转化
hydrolysis [hai'drɔlisis] *n.* 水解
specific rotation 比旋；旋光率
levorotatory [ˌli:vəu'rəutətəri] *n.* 左旋性
dextrorotatory [ˌdekstrəu'rəutətəri] *n.* 右旋性