全国高等农林院校"十一五"规划教材

资源环境科学专业英语

English Course for Science of Resources and Environment

许修宏　主编

中国农业出版社

全国高等农林院校“十一五”规划教材

资源环境科学专业英语

English Course for Science of Resources and Environment

许修宏　主编

中 国 农 业 出 版 社

图书在版编目（CIP）数据

资源环境科学专业英语 / 许修宏主编 . —北京：中国农业出版社，2007.10

ISBN 978-7-109-11939-0

Ⅰ. 资… Ⅱ. 许… Ⅲ. ①资源保护－英语－高等学校－教材②环境保护－英语－高等学校－教材 Ⅳ. H31

中国版本图书馆 CIP 数据核字（2007）第 130985 号

中国农业出版社出版

（北京市朝阳区农展馆北路 2 号）

（邮政编码 100026）

责任编辑 李国忠

中国农业出版社印刷厂印刷 新华书店北京发行所发行

2008 年 1 月第 1 版 2008 年 1 月北京第 1 次印刷

开本：720mm×960mm 1/16 印张：24.25

字数：457 千字

定价：34.00 元

主　编　许修宏　（东北农业大学）
副主编　李春艳　（东北农业大学）
曲娟娟　（东北农业大学）
乌云塔娜　（内蒙古农业大学）
蔡柏岩　（黑龙江大学）
参　编　时黎霞　（长春理工大学）
郭亚芬　（东北林业大学）
李青丰　（内蒙古农业大学）
李淑敏　（东北农业大学）
张伟丽　（仲凯农业技术学院）
黄雅曦　（黑龙江大学）
马怀良　（牡丹江师范学院）

前　言

资源与环境问题是当前世界上人类面临的重要问题之一。资源的短缺和环境的恶化不仅成为制约经济发展的关键因素，而且有足够的证据表明，如果人类不改变目前的生产、生活方式，继续挥霍自然资源、破坏生态环境，人类的生存将受到威胁。化石能源耗竭、物种灭绝、大江大河的污染、冰川的消融、极端的天气、洪水的泛滥、沙尘暴等，这些词汇已经为人们所熟知。近几十年来，地球上的每个人都切身感受到气候恶化的趋势，人类已经开始品尝挥霍资源、破坏环境带来的苦果。在这种背景下，人类现在比历史上的任何时期都更加关注资源与环境问题。如果说在过去的20世纪中，人类向地球索取的太多，也破坏了太多。那么21世纪则应是恢复和重建的世纪，人类必须寻找到一条与自然界和谐共处的途径，惟有这样，人类才能保持永久的生息和繁荣。

资源与环境问题涉及的学科领域较多，本书的内容基本上围绕自然资源的现状和生态环境的保护两个主题而展开。资源方面的内容涉及能源、水资源、生物资源，环境方面的内容涉及气候变化、空气污染、水污染、固体废弃物及污泥的处理、生物修复、生态农业等。另外，考虑到农业资源环境专业学生的专业特点，增加了一些植物营养学方面的内容。

本书采用的文章主要选自国外相关的教材，同时从互联网上下载了部分文章，注重文章的可读性与深度的结合，力求使读者在提高科技英语知识和阅读技巧的同时，获得一定的学科前沿信息。

本书编写过程中，李春艳、曲娟娟做了大量的校对及音标标注工作，王

晶、孔德勇、姜海波、李楠、曲小爽等为本书部分单元的选材、出题付出了宝贵的时间，在此表示感谢。

限于编者水平，书中难免有疏漏之处，请广大读者指正。

许修宏

2007年11月

目　　录

Unit 1

Part A

Liquid fuels

Liquid fuels are indispensable to the US economy. Petroleum, essential for the transportation sector as well as the chemical industry, makes up approximately 42% of total US energy consumption. At present, the United States imports about one half of its petroleum and is projected to import nearly 100% within 10 to 15 years. Barring radically improved electric battery technologies, a shift from petroleum to alternative liquid and gaseous fuels will have to be made. The analysis in this section is focused on the potential of three liquid fuels: **ethanol**, **methanol**, and **hydrogen.**

Ethanol can be obtained by yeast- or bacteria-mediated fermentation of sugar crops, such as **sugarcane**, **sugar beet**, and **sweet sorghum**, or of **starchy** crops, such as corn and **cassava.** It can also be obtained, **albeit** at lower yields, from **cellulose**, a sugar polymer from woody crops, through acid or **enzymatic hydrolysis** followed by fermentation. Methanol can be obtained from wood or woody crops by means of a wood **gasification** process followed by compression and methanol synthesis. **Biodiesel** fuels can be obtained from oil crops, such as soybean, rapeseed, sunflowers, and palms, by extracting the oil with suitable solvents or through mechanical pressing and then converting the oil into diesel fuel by a **transesterification** process.

Ethanol and methanol

Ethanol is a good substitute for gasoline in spark-ignition engines. Methanol can also be used as a substitute for gasoline. Of course, existing vehicles cannot run on 100% ethanol or methanol fuel unless engines are modified substantially.

The total fossil energy expended to produce 1 liter of ethanol from corn is 10,200 kcal, but note that 1 liter of ethanol has an energy value of only 5130 kcal. Thus, there is an energy imbalance causing a net energy loss. Approximately 53% of the total cost of producing ethanol in a large, modern plant is for the corn raw material. The total energy inputs for producing ethanol using corn can be partially offset when the dried distillers grain produced is fed to livestock. Although the feed value of the dried distillers grain reduces the total energy inputs by 8% to 24%, the energy budget remains negative.

The major energy input in ethanol production, approximately 40% overall, is fuel needed to run the **distillation** process. In the production process, special membranes can separate the ethanol from the so-called beer produced by fermentation. The most promising systems rely on distillation to bring the ethanol concentration up to 90%, and selective-membrane processes are used to further raise the ethanol concentration to 99.5%. The energy input for this upgrading is approximately 1,280 kcal/liter. In laboratory tests, the total input for producing a liter of ethanol can potentially be reduced from 10,200 to 6,200 kcal by using membranes, but even then the energy balance remains negative. Any benefits from ethanol production, including the corn by-products, are negated by the environmental pollution costs incurred from ethanol production. Intensive corn production in the United States causes serious soil erosion and also requires the further draw-down of groundwater resources. Another environmental problem is caused by the large quantity of **stillage or effluent** produced. During the fermentation process approximately 13 liters of sewage effluent is produced and placed in the sewage system for each liter of ethanol produced.

Although ethanol has been advertised as reducing air pollution when mixed with gasoline or burned as the only fuel, there is no reduction when the entire production system is considered. Ethanol does release less **carbon monoxide** and **sulfur oxides** than gasoline and diesel fuels. However, nitrogen oxides, **formaldehydes**, other **aldehydes** (all serious air pollutants) are associated with the burning of ethanol as fuel mixture with or without gasoline.

Also, the production and use of ethanol fuel contribute to the increase in atmospheric carbon dioxide and to global warming, because twice as much fossil energy is burned in ethanol production than is produced as ethanol[1].

Ethanol produced from corn clearly is not a renewable energy source. Its production adds to the depletion of agricultural resources and raises ethical questions at a time when food supplies must increase to meet the basic needs of the rapidly growing world population.

Methanol is another potential fuel for internal combustion engines. Various raw materials can be used for methanol production, including natural gas, coal, wood, and municipal solid wastes. At present, the primary source of methanol is natural gas. *The major limitation in using biomass for methanol production is the enormous quantities needed for a plant with suitable economies of scale*[2]. A suitably large methanol plant would require at least 1,250 tons of dry biomass per day for processing. More than 150,000 ha of forest would be needed to supply one plant. Biomass generally is not available in such enormous quantities from extensive forests and at acceptable prices.

If methanol from biomass were used as a substitute for oil in the United States, from 250 to 430 million ha of land would be needed to supply the raw material. This land area is greater than the 162 million ha of US cropland now in production. Although methanol production from biomass may be impractical because of the enormous size of the conversion plants, it is significantly more efficient than the ethanol production system based on both energy output and economics.

Compared to gasoline and diesel fuel, both methanol and ethanol reduce the amount of carbon monoxide and sulfur oxide pollutants produced, however both contribute other major air pollutants such as aldehydes and alcohol. Air pollutants from these fuels worsen the **tropospheric ozone** problem because of the emissions of nitrogen oxides from the richer mixtures used in the combustion engines.

Hydrogen

Gaseous hydrogen, produced by the **electrolysis** of water, is another alternative to petroleum fuels. Using solar electric technologies for its production, hydrogen has the potential to serve as a renewable gaseous and liquid fuel for transportation vehicles. In addition hydrogen can be used as an energy storage system for electrical solar energy technologies, like **photovoltaics.**

The material inputs for a hydrogen production facility are primarily those needed to build a solar electric production facility. The energy required to produce 1 billion kWh of hydrogen is 1.3 billion kWh of electricity. If current photovoltaics require 2,700 ha/ billion kWh, then a total area of 3,510 ha would be needed to supply the equivalent of 1 billion kWh of hydrogen fuel. Based on US per capita liquid fuel needs, a facility covering approximately 0.15 ha would be needed to produce a year's requirement of liquid hydrogen. In such a facility, the water requirement for electrolytic production of 1 billion kWh/yr equivalent of hydrogen is approximately 300 million liters/yr.

To consider hydrogen as a substitute for gasoline: 9.5 kg of hydrogen produces energy equivalent to that produced by 25 kg of gasoline. Storing 25 kg of gasoline requires a tank with a mass of 17 kg, whereas the storage of 9.5 kg of hydrogen requires 55 kg. Part of the reason for this difference is that the volume of hydrogen fuel is about four times greater than that for the same energy content of gasoline. Although the hydrogen storage vessel is large, hydrogen burns 1.33 times more efficiently than gasoline in automobiles. In tests, a BMW 74Si liquid-hydrogen test vehicle with a tank weight of 75 kg, and the energy equivalent of 40 liters (320,000 kcal) of gasoline, had a cruising range in traffic of 400 km or a fuel efficiency of 10 km per liter.

At present, commercial hydrogen is more expensive than gasoline. For example, assuming 5c per kWh of electricity from a conventional power plant, hydrogen would cost 9c per kWh. This cost is the equivalent of 67 c /liter of gasoline. Gasoline sells at the pump in the United States for approximately 30 c /liter. However, estimates are that the real cost of burning a liter of gasoline ranges from \$1.06 to \$1.32, when production, pollution, and other external costs are included. Therefore, based on these calculations hydrogen fuel may eventually be competitive.

Some of the oxygen gas produced during the electrolysis of water can be used to offset the cost of hydrogen. Also the oxygen can be combined with hydrogen in a fuel cell, like those used in the manned space flights. Hydrogen fuel cells used in rural and suburban areas as electricity sources could help decentralize the power grid, allowing central power facilities to decrease output, save transmission costs, and make mass-produced, economical energy available to industry.

Compared with ethanol, less land is required for hydrogen production that uses photovoltaics to produce the needed electricity. The environmental impacts of hydrogen are minimal. The negative impacts that occur during production are all associated with the solar electric technology used in production. Water for the production of hydrogen may be a problem in the arid regions of the United States, but the amount required is relatively small compared with the demand for irrigation water in agriculture. Although hydrogen fuel produces emissions of nitrogen oxides and **hydrogen peroxide** pollutants, the amounts are about one-third lower than those produced from gasoline engines. Based on this comparative analysis, hydrogen fuel may be a cost-effective alternative to gasoline, especially if the environmental and subsidy costs of gasoline are taken into account.

Glossary

ethanol ['eθənɔl] *n.* 乙醇，酒精
methanol ['meθənɔl] *n.* 甲醇
hydrogen ['haidrədʒən] *n.* 氢
sugarcane ['ʃugəkein] *n.* 甘蔗
sugar beet ['ʃugə biːt] *n.* 甜菜
sweet sorghum [swiːt 'sɔːgəm] 甜高粱
starchy ['stɑːtʃi] *a.* 淀粉的
cassava [kə'sɑːvə] *n.* 木薯
albeit [ɔːl'biːit] *conj.* 纵然；虽然
cellulose ['seljuləus] *n.* 纤维素
enzymatic [ˌenzai'mætik] *a.* 酶的
hydrolysis [hai'drɔlisis] *n.* 水解（作用）

gasification [ˌgæsifiˈkeiʃən] *n.* 气化
biodiesel [ˌbaiəuˈdiːzəl] *n.* 生物柴油
transesterification [ˌtrænzestərifiˈkeiʃən] *n.* 转酯（基）作用，酯基转移作用
distillation [ˌdistiˈleiʃən] *n.* 蒸馏
stillage [ˈstilidʒ] *n.* 釜馏物
effluent [ˈefluənt] *n.* 污水，废水，流出物
carbon monoxide [ˈkɑːbən mɔˈnɔksaid] 一氧化碳
sulfur oxide [ˈsʌlfəˈɔksaid] 氧化硫
formaldehyde [fɔːˈmældihaid] *n.* 甲醛
aldehyde [ˈældihaid] *n.* 醛类
tropospheric [ˌtrɔpəusˈfiərik] *a.* 对流层的
ozone [ˈəuzəun] *n.* 臭氧
electrolysis [ilekˈtrɔlisis] *n.* 电解
photovoltaics [ˌfəutəuvɔlˈteiiks] *n.* 太阳能电池
hydrogen peroxide [ˈhaidrədʒən pəˈrɔksaid] 过氧化氢

Notes

1. *Also, the production and use of ethanol fuel contribute to the increase in atmospheric carbon dioxide and to global warming, because twice as much fossil energy is burned in ethanol production than is produced as ethanol.*

而且，生产和使用乙醇燃料会增加大气中二氧化碳的含量并加重全球（气候）变暖，这是因为在生产乙醇过程中，燃烧的化石能源的量要两倍于乙醇燃料（本身）产生的能量。

2. *The major limitation in using biomass for methanol production is the enormous quantities needed for a plant with suitable economies of scale.*

利用生物质生产甲醇主要的局限性就在于（难以满足）一个具有相当经济规模的工厂对于生物质的巨大需求量。言外之意是如果工厂的规模小，就很难取得经济效益。而规模大的工厂则需要大量原料（生物质）。

Exercises

Ⅰ. True or false?

1. Petroleum makes up one half of total US energy consumption.
2. Existing vehicles may run on 100% ethanol or methanol fuel if engines are modified substantially.
3. The total fossil energy expended to produce 1 liter of ethanol from corn is more than the energy value of 1 liter of ethanol.
4. The dried distillers grain can be fed to livestock and the feed value reduces the total energy inputs for producing ethanol.
5. According to the author, ethanol produced from corn is a renewable energy source.
6. Compared with gasoline and diesel fuel, both methanol and ethanol cause no air pollution.
7. Hydrogen may become a renewable gaseous and liquid fuel for transportation vehicles.
8. Methanol production is more efficient than the ethanol production based on both energy output and economics.
9. The volume of gasoline is smaller than that for the same energy content of hydrogen fuel.
10. According to the author, gasoline may eventually be competitive because it is cheaper than hydrogen.

Ⅱ. Completion

1. The three liquid fuels mentioned in this article include __________, __________ and __________.
2. Though at lower yields, alcohol can also be obtained from __________.
3. Biodiesel fuels can be obtained from oil crops by extracting the oil with suitable solvents or through mechanical pressing and then converting the oil into diesel fuel by a __________ process.
4. Approximately 40% energy input in ethanol production is fuel needed to run the __________ process.