Experiences, Challenging Issues and Future Prospects on Biodiesel Implementation in Korea

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Jin-Suk Lee

Bioenergy Research Center, KIER

KIER 한국에너지기술연구원
KOREA INSTITUTE OF ENERGY RESEARCH

PRESENTATION AGENDA

- Introduction
- Current Status on Biodiesel
- Challenging Issues
- Prospects
- Summary

I. Introduction

Energy Consumption in Korea

For Transportation sector (1.4×10^7 vehicles) :

- **Gasoline**
  1.0×10^7 ton/year

- **Diesel (5.0×10^6 vehicles)**
  2.0×10^7 ton/year

  All crude oils are imported !

Why Biodiesel in Korea?

- All dependence on petro-oil
- Severe Air pollution over Seoul Metropolitan area.

  The major portion (over 50 %) of air pollutants are from diesel fuelled vehicles.
- Concerns over global warming

  Korea needs to follow Kyoto protocol from 2013

Biodiesel is emerging as a promising solution to above problems

II. Current Status on Biodiesel

Issues on Biodiesel

Issues :

- **Evaluation of Biodiesel as a Motor Fuel**
  (Fleet tests and Demonstration supply)

- **Biodiesel Standardization**

- **Fuel Distribution Infra**

- **Security for Feedstocks' Supply**

Chronicles for Biodiesel

2002 Feb. Emission tests on pure biodiesel and biodiesel blending fuels conducted)

May Demonstration supply of BD-20 started at the designated areas (Seoul Metropolitan, Chonbuk Province)

Dec. Full-scale commercial plant was constructed (100,000ton/year)

2004 Sep. Korean biodiesel standards set-up & Fleet tests

2006 July Biodiesel fuels (BD5, BD20) available nationwide

Map of South Korea

Site for
Demonstration Supply

Infra for BD20 Supply

Gas Stations for biodiesel

Full-Scale Biodiesel Plant

Biodiesel Plant (100,000 tons/year)

Korean Biodiesel Standards

Parameter	Unit	BD100	BD20	BD5
FAME	wt%	96.5 ↑	20±3	5↓
Density, 15°C	Kg/m³	860-900	815-855	815-855
Kinematic viscosity, 40°C	mm²/sec	1.9-5.0	1.9-5.5	1.9-5.5
Distillate, 90%	°C	-	360 ↓	360 ↓
Flash point	°C	120 ↑	40 ↑	40 ↑
Carbon residue	wt%	0.1 ↓	-	-
Carbon residue, 10%	wt%	-	0.15 ↓	0.15 ↓
Pour point	°C	-	0 ↓, W: -17.5 ↓	0 ↓, W: -17.5 ↓
CFPP	°C	0 ↓	-16 ↓	-16 ↓
Sulfur	mg/kg	10 ↓	30 ↓	30 ↓
Ash	wt%	0.01 ↓	0.01 ↓	0.02 ↓
Acidity	mg KOH/g	0.5 ↓	0.1 ↓	0.06 ↓
Oxidation stability	hour	6 ↑	-	-
Cetane number	-	-	45 ↑	45 ↑
Total Glycerol	wt%	0.24 ↓	-	-0
Na+K	mg/kg	5 ↓	-	-
Ca+Mg	mg/kg	5 ↓	-	-
P	mg/kg	10 ↓	-	-
Methanol	wt%	0.2 ↓	-	-
Water & Sediment	Vol %	0.05 ↓	0.02 ↓	0.02 ↓
Cu corrosion, 3h	-	1 ↓ @ 50°C	1↓ @ 100°C	1↓ @ 100°C

Fleet Tests under Real Conditions

- **Fleet tests have been completed to test the validity of new Korean biodiesel standards in September of 2004**
- **Major Korean car, oil companies and biodiesel producers have participated into the project**
- **The fleet tests have been done for two years (by July of 2006)**
- **After the fleet tests, biodiesel dissemination has been more activated**

Evaluation for Biodiesel Blended Fuels

- **Project period: Aug. 2004 – July 2006**
- **Tested Fuels : BD5, BD20**
- **Tested vehicles: Santa Fe, Sorento (Hyundai Inc), Rexton (Ssangyong Inc)**

What has been done :

- **Emission tests every 10,000km**
- **Check on Fuel injection system**

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Fuel Quality Management
(Effective from July 2006)

Oil Refineries
(Diesel-BD100 blending)

→ BD5 (Gas Stations)

90,000kL Biodiesel/yr
(Voluntary Agreement)

Diesel ↓↑ Biodiesel (BD100)

Biodiesel producers
(BD100-Diesel blending)

→ BD20 (Captive Fleets)

↑ Canola oil, Waste fats

Farmers (Canola oil),
Renderers (Waste fats)

Biodiesel Companies (2006)

Company Name	Capacity, kL/year
Neo-Energy Inc	72,000
BND Energy	39,000
3M Safety Development	36,000
Eco-Enertech Inc	17,000
Danseok Industry	6,000
BDK	17,000
Bizel	5,000
C&G	9,000
Mudeung Bioenergy	3,000
Total	204,000

Diesel and Biodiesel Prices

	Diesel			Biodiesel
	2004	2005	2006	2005
Diesel untaxed, $/L	0.31	0.51	0.51*	-
Total Tax, $/L	0.34	0.41	0.51	-
Diesel fully taxed, $/L	0.65	0.92	1.02	-
Biodiesel, min, $/L				0.70
Biodiesel, max, $/L				0.80

* : based on $ 50/bbl crude oil

Action Plan for Bio-diesel

X 10^3 toe

	2004	2006	2008	2010	2012
Biogas	42	47	52	58	63
LFG	106	212	291	344	397
Biodiesel	147	184	368	460	552
Total	295	443	711	862	1,012

III. Challenging Issues

Challenging Issues

- Development of an innovative biodiesel process
- Security for the supply of raw material
  - Biodiesel production is getting activated in Korea
  - Most raw materials (over 90%) are imported
- Implementation of biodiesel in non-road sector (Locomotive and boat etc.)

Innovative Processes

1. Biodiesel from used cooking oil (UCO)
2. Modular Biodiesel Process (MBP)

UCO Biodiesel Plant
(60ton/year)

Modular Biodiesel Plant (5,000ton/year)

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Raw Materials Supply

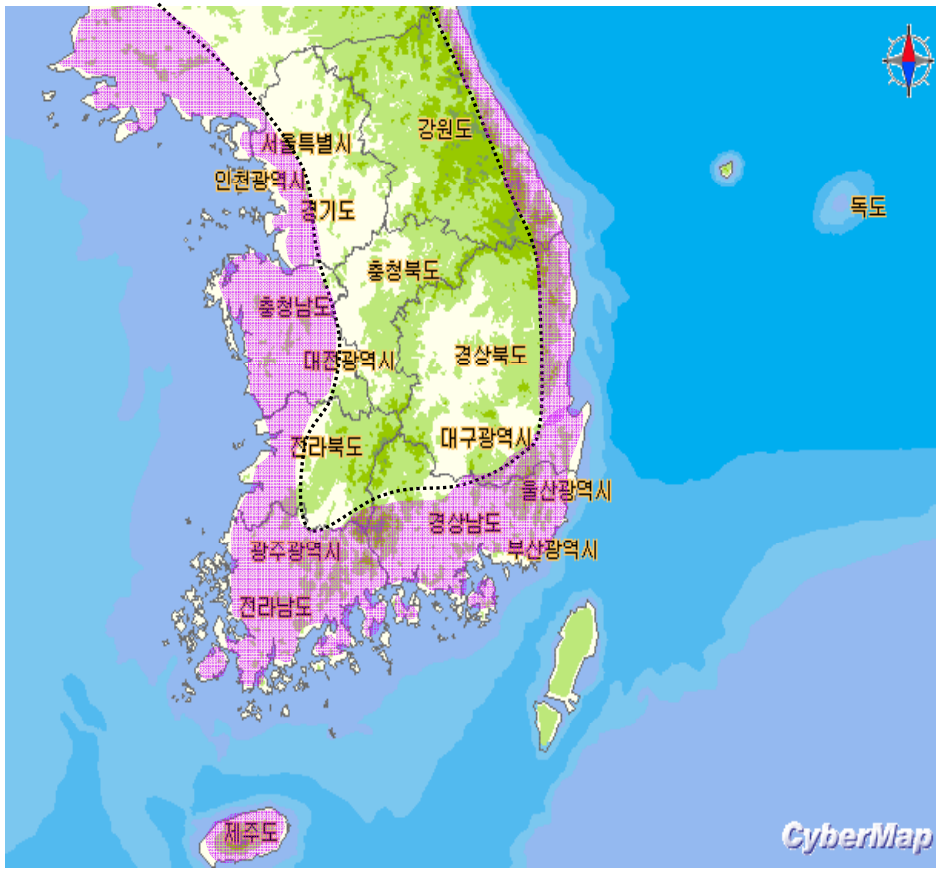
Various works are under investigation to enhance the security of feedstock

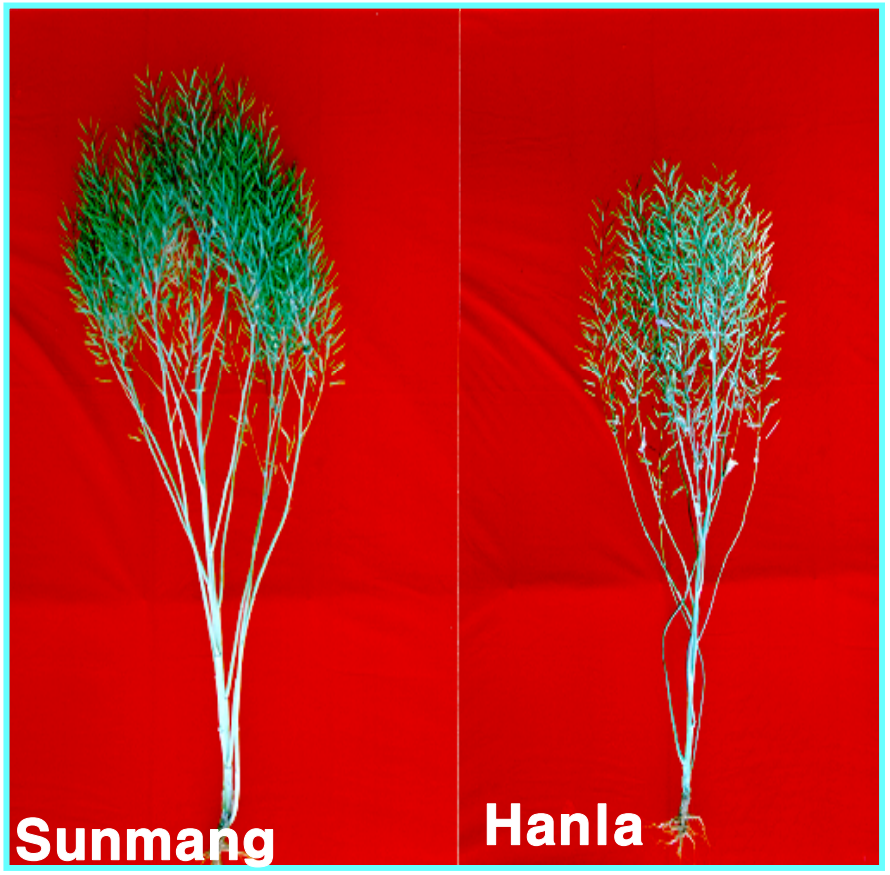
(- Utilization of set-aside land to cultivate rapeseed

- Utilization of used cooking oil

- Energy crop plantation)

R&D on Winter Canola





Potential area: 300,000 – 500,000 ha

Expected Canola oil : 450,000 – 750,000 ton/yr

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Jatropha Plantation

- **Korean weather is not suitable for Jatropha cultivation due to winter season**
- **Korean biodiesel companies have strong interests on Jatropha plantation in Southeast Asia Region**
- **Some demonstration projects for Jatropha plantation are under way**

Jatropha Plantation Farm in Mindanao, The Philliphines

- **Established in 2005**
- **Area : 1,000ha**

Tests of BD20 on Locomotive

Prospects

1. Implementation of biodiesel is quite successful in Korea.

2. Innovative biodiesel processes have been developed and the technology transfer is under discussion with some countries including Colombia, China and Zimbabwe.

3. Stable supply of the feedstock is a major concern. Plantation of oil crops is a promising option.