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***Production of energy from***

***Bovine rumen gases***

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**Introduction:**

The world society today poses three questions towards 2050 1) how will it cover

The food demands that would generate world population growth 2) how will it give

Response to energy demands due to the lack of availability of fossil fuels

And 3) how to avoid the increase of temperature of the planet produced by the increase

Of greenhouse gases that generate "Climate Change"

**World population growth and food demands**

According to the report "United Nations Demographic Projections"

(UN), the world that now has 7.2 billion people, and by 2050,

To reach 9,600 million

Agriculture in this century faces many challenges: it has to produce more food

For a growing population and must contribute to the overall development of the numerous

Developing countries, by adopting more

Effective and sustainable and adapting to climate change.

Urbanization is forecast to continue to grow at an accelerated rate,

70% of the world's population by 2050 (compared to 49% in

And the rural population, after reaching a maximum level over the next

Decade will decline.

At the same time, it is estimated that per capita incomes in 2050 will multiply

Current level. There is a consensus among analysts that it is likely

In the future, the tendency of the economies of developing countries to grow

Much faster than those of developed countries.

The demand for livestock and dairy products that are more sensitive to

Increase in developing countries will grow faster than

cereals.

Projections show that to feed a world population of 9.1 billion

People in 2050 will need to increase food production by 70% between

2010 and 2050.

Life expectancy at birth (world average) will rise from 69 years (2005-2010) to 76

Years in 2050 In less developed countries it would go from the present 58 to the 70 years (2050).

**Availability of fossil fuels**

At the end of the 20th century, 85% of all world trade energy came from

Fossil fuels, distributed as follows: petroleum 40%, natural gas 23%,

Coal 21% and other fuels 1%.

The current energy matrix is ​​organized around fossil fuels (petroleum,

Gas and coal), which provide nearly 80% of the world's current energy consumption.

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Only oil contributes more than a third of all energy sources

Primary, which shows the global dependence of it.

There has now been a debate about the pros and cons of

Structure of the current energy matrix; In particular on sustainability in the

Medium and long term of these patterns of consumption.

The debate takes place between two main axes: a) environmental problems and b) the

Finite character of fossil fuels.

More recently and as a result of the rise in oil prices a new

Current opinion has formed around the problem of the shortage of this product,

The arrival at its "peak" production and the need to think the future "no oil"

Energy networks will tend to become more intelligent and efficient, solving the

Intermittent supply from renewable energies,

Cogeneration and energy efficiency to the maximum.

Fossil fuels current CO2 emitter by a system without CO2 emissions goes to

A formidable investment in the coming decades

**Climate change and greenhouse gases The greenhouse effect**

During the last century, concentrations of greenhouse gases in the atmosphere

Have risen sharply. This is due, in large measure, to the increase in

Production of the same from human activities or anthropogenic sources,

Such as the burning of fossil fuels.

***Figure 1: Distribution of World Emissions South America and Argentina***

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Greenhouse gases have different global warming capabilities, based on

In its radioactive impact and its duration in the atmosphere.

The main source of CO 2 emissions is the burning of fossil fuels, emissions

Of some significance in the industrial sector and a strong capacity of capture and emission

By practices that make land use change and afforestation.

***Figure 2: Solar rays and the generation of the greenhouse effect***

Methane is the second most important of the greenhouse gases. Its relevance

is accentuated as its global warming potential is 21 times that of CO 2. The

Anthropogenic sources of methane are: 1) the fermentation of organic matter in the environment

anaerobic; 2) fugitive emissions from gas and oil systems and coal mining

And 3) some industrial processes.

According to the Stern Report, which studied the impact of climate change and warming

Global distribution of GHG emissions by sector is:

Owing to electricity generation, 14% to industry, 14% to transport, 8% to

Buildings and 5% more energy-related activities. This

2/3 of the total and corresponds to emissions motivated by the use of energy.

Approximately the remaining 1/3 is distributed as follows: 18% for the use of the

(Including deforestation), 14% for agriculture and 3% for waste

Developed countries are mainly CO2 emitters, while those

They are developing, which are producers of agricultural raw materials,

They have significant emissions of CH 4 and N 2 O.

In an analysis of global emissions, South America generates, as a whole, 5% of

Global emissions and therefore emissions of greenhouse gases should be considered

Are a problem common to all countries, but their

Are differentiated.

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**Livestock and greenhouse gas emissions.**

The world population of bovines is estimated in the order of 1350 million head,

Occupying 3.4 million hectares (26% of the Earth's land surface)

South America contains approximately 312 million cattle in its territory,

being

Brazil

Y

Argentina

Who

they have

higher

population

Cattle are estimated to provide 16% of calories consumed and 33% of calories consumed.

Protein contributions from the diet of the inhabitants of the planet

It is estimated that 1.3 billion people participate in the chain and 600 million poor people

Producers have it as a way of life

***Figure 3: Emissions of greenhouse gases generated by livestock***

The FAO defines livestock as responsible for 18% in its report "Livestock Long

Shadow "in a study of the carbon footprint taking the whole chain of meat and milk

bovine

In Argentina, according to the GHG inventory for the year 2000, prepared in the framework of the

Second National Communication presented to the UNFCCC, livestock contributes more than

30% of total emissions produced by human activities in the country,

The sector contributing with two of these gases, methane and nitrous oxide.

Also according to the Second National Communication, beef cattle

Meat and milk are responsible for approximately 95% of these emissions,

With the remaining 5% corresponding to all other species of production (sheep,

Goats, swine, equines, birds, buffalo, asnales, mulos and South American camelids).

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**The rumen a fermentation chamber**

Bovine animals are herbivorous mammals that have in their digestive system three

One called rumen is where the digestion of

Cellulose and other polysaccharides by microbial activity,

The rumen has a relatively large adult bovine with a

100 to 150 liters and is at a constant temperature and acidity (39 ° C, pH 6.5).

***Figure 4: Location of the rumen in the bovine abdominal cavity***

The fodder reaches the rumen or tummy, mixed with saliva containing bicarbonate and there is

Subjected to a rotational movement and mixing during which the

Bacterial fermentations. This peristaltic action facilitates microbial adherence to

Suspended cellulosic material.

The food remains in the rumen from nine to twelve hours. Bacteria and Fungi

Cellulolytics act to produce the disaccharide cellobiose and glucose. This one experiences a

Bacterial action in which acetic, propionic and

Butyric acid, carbon dioxide and methane.

Fatty acids cross the wall of the rumen and pass into the blood. From there they go to the

Tissues where they are used as the main source of energy. In addition, the

Rumen microorganisms synthesize essential amino acids and vitamins for the animal

**Methane emissions generated in the rumen**

The production of methane gas is part of the normal digestive processes of animals.

During digestion, the microorganisms present in the digestive tract ferment the

Food consumed by the animal. This microbial fermentation process, known as

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Enteric fermentation, produces methane as a by-product, which is belch by the

animal.

Under normal conditions, ruminants are fed

cellulose. The fermentation process, which takes place in the rumen, offers an opportunity

Microorganisms to split the cellulose into

Can be absorbed and used by the animal.

Methane-producing bacteria are responsible for the production of methane and, although

Constitute a very small fraction of the total microbial population,

Very important function, by providing a mechanism to eliminate the hydrogen produced in

The rumen.

***Figure 5: Cross section of the bovine abdominal cavity with the distribution of the***

***Forage consumed inside the rumen***

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**N2O**

**CH4**

**Urine**

**Matter**

**faecal**

**Ruminal fluid**

**Eruption**

**Reticle**

**Rumen**

**Esophagus**

Intestine

**Bladder**

**Vagina**

**N2O**

**CH4**

**Urine**

**Matter**

**faecal**

**Ruminal fluid**

**Eruption**

**Reticle**

**Rumen**

**Esophagus**

Intestine

**Bladder**

**Vagina**

**Emissions of gases greenhouse effect**

**Generated by ruminants**

**Methane and Nitrous Oxide**

***Figure 6: Outline of the production and eructation of ruminal gases (CH4 and CO2)***

Bovine animals have a true microbial fermentation chamber in the

Which carbohydrates are the most important source of energy of the food consumed.

Microorganisms in the rumen allow cattle to obtain

Fibrous carbohydrates (cellulose and hemicellulose) that ferment slowly and

Fibrous (starches and sugars) that do so quickly and almost completely in the

Rumen.

During ruminal fermentation, the population of microorganisms

Bacteria degrade to carbohydrates to produce gases (methane and carbon dioxide)

Heat and acids. Acetic acid, propionic acid and butyric acid make up most of the

Acids produced in the rumen by approximately 95%.

The formed gases (CH4 and CO2) are burst and the energy present in the methane is

misses. Then the volatile fatty acids (VFA) are transformed into the final products

Of the microbial fermentation that are then absorbed through the ruminal mucosa.

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**Comparison of a bovine and a biodigestor similarities and differences**

Comparison of a bovine and a biodigester

Production of

methane

CH4 + CO2

CH4 + CO2

Ruminant gases

CO2 + CH4 + others

Fermentation

Entry

Departure

Ruminant Gases

Biogas

CO2 70%

CH4 25%

CO2 40%

CH4 60%

***Figure 7: Comparison of bovine rumen and a biodigester***

1) The microbial fermentation that takes place in the bovine rumen behaves in

Similar form to a biodigestor in both cases the microbial activity develops in

Anaerobiosis ie in the absence of oxygen

2) The accumulation of gases in the biodigester is carried out at the top and

Disposal is through a pipe that allows to release it, in the bovine the gases are

Accumulate in the upper end of the rumen dorsal sac the elimination of gases

Performs during the physiological digestive process known as eructation that expels

Each one to three minutes through the esophagus depending on the diet consumed

3) Organic matter in the bovine rumen is mixed from the contractions

Runino reticulares while in the biodigestor in some cases a mechanical mixer

Allows organic matter to contact bacterial microflora

4) Temperature is a fundamental component for the development of

Microorganisms in the rumen as well as in the interior of the biodigester in the first case.

Own metabolism of the animal confers the autonomous temperature of 38.5 C for the

In the biodigestor depends on the external temperature and in some cases it is

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The incorporation of caloric energy from the outside to allow the development of

bacterial

5) In the bovine the mouth is its organ of grasp of the food that via the esophagus is directed

To the rumen then finished digestive processes of defecation allows you to eliminate and

To discharge the organic matter that was not absorbed in its passage through the digestive system El

Biodigestor requires an operator for both loading and unloading

6) The volume of gases and the composition of CO2 and CH4 in the bovine depends

The size of the biodigester of the components

Fermentative processes the external temperature In the case of the bovine its weight will determine

The size of the rumen and the gas production also the digestibility of the diet

Is also responsible for the different amounts of methane produced

7) The two major gases in both biogas and rumen are CO2 and CH4 La

Concentration of CH4 is in the biogas between 50 and 60% in the

CH4 concentrations of 25% and CO2 70%

8) In both cases both in biogas and in ruminal gases the presence of H2S

Present in traces but with high capacity of corrosion makes difficult its use in motors if it is not

Previously sequestered with monoethanolamine and / or ferrous oxide

9) To generate caloric energy biogas can be used directly without process

Purification prior to some 5000cal / cubic meter energy quality is lower if the

Compares with that produced by natural gas 9000cal / cubic meter In rumen gases

To generate caloric energy it becomes necessary to pass a purification process in the

That CO2 capture takes place

10) In an adult bovine animal with a rumen with a capacity of approximately 100 kg the

Collection is of the order of 1 m3 / day with 20-25% of methane, in the biodigester the

Gas production will depend on the volume of the incorporated inputs and the temperature

11) The effluents from the discharge of the biodigester can be used as

Fertilizer requiring mechanical energy for its transfer and distribution on soils

On the contrary the bovine for being a mobile digester and having autonomous translation its

Fecal matter is directly eliminated on the ground

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**Phase I**

**Collection of gases produced inside bovine rumen**

The method consists of puncture-installing a microcannula (endotracheal tube for use

In the back of the bovine rumen allowing

Gases produced in their interior and to direct them through a system valves

Unidirectional to a flexible container or bag for storage located in

The back of the animal

The device is constituted by a flexible container or bag which in connection with

A one-way valve allows the flow of gases from the rumen into the interior of the

container,

The ruminal-reticular contractions of the digestive system allow the

Towards the collection bag through the intraruminal cannula

***Photo1: Bovine with the gas collection system built on the back***

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**Collection System**

**Of ruminal gases**

CH4 + CO2

CH4 + CO2

Ruminant gases

CO2 + CH4 + others

Valve

unidirectional

***Figure 8: Scheme of the collection system with collection bag on the back***

***of bovine***

**Description of the gas collection system**

**Rumen Fistula:**

The newly fed bovine is installed in the stump so that the rumen with content

Food is in contact the dorsal sac of the rumen with the abdominal wall

An area of ​​10 cm 2 is shaved in the center of which is located puncture site 5 cm, behind

Of the last rib and 5 cm below the transverse process of the third vertebra

Left lumbar The area is disinfected with a povidone-iodine solution.

Local anesthesia is performed with 15 cm3 local anesthesia (2% lidocaine), which

Infiltrates the subcutaneous cellular tissue and external and internal oblique abdominal muscles.

A stainless steel mini-car of 0.5 cm diameter with a sharp end in one

Of its ends serves to puncture the skin, the muscular planes and peritoneum

And the dorsal rumen sac wall

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***Foto2 Minitrocar and microcanula ruminal***

Tube

endotracheal

Switch punsante

Content

Ruminal

Ruminant gases

CO2 + CH4

Skin

Abdominal muscles

Parietal Peritoneum

Rumen Wall

Washer

Fixing

Inflatable hose

Syringe 10 cm3

**Intraruminal cannula**

***Figure 9: Schematic system of puncture and installation of microcanula inside the***

***Dorsal rumen sac***

After the puncture is done, the minitrocar is removed, leaving the end of the

Microcánula (Endotracheal tube of pediatric use N 4,5 to which the ball of his

Anterior extremity within the rumen.

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**Puncture touch**

**Pediatric Endotracheal Tube**

**Inflatable hose**

**Washer**

Introduction of the endoruminal cannula by ruminal puncture

***Photo3: Puncture and introduction of ruminal microcannula***

The correct location of the microcanula is recognized by the flow of the ruminal gases that

Are easily recognized in addition to the suis generis odor of rumen gases

Description of the cannula

The outer part of the microcanula has a plastic washer 5 cm

Diameter, to fix it and ensure the system's tightness

After 10 days the cannula installed inside the rumen produces scarring in the

Point of puncture by the adhesion that takes place between the parietal and visceral peritoneum

Of the ruminal wall

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**RUMINAL GAS COLLECTION CANULA**

Gas

Gas (CO2 + CH4)

solids

liquid

Gas

liquids

Canula

inflatable ball

Filters

Filter

Canula

**RUMINAL CYCLE**

**A COORDINATED CONTRACTION SET OF THE WALLS OF THE RUMEN**

**IT HAS PLACE EVERY 1 TO 3 MINUTES**

solid

***Figure 10: Schematic of location and functioning of the ruminal microcanula***

**Collection system:**

A) Endotracheal tube for pediatric use consisting of a plastic tube of 5.5

Mm of external diameter and 2 mm of thickness, bored, was fixed to a circular patch of

Rubber of 10 cm in diameter.

B) Unidirectional valve: a one-way anesthetic valve (ADOX,

Argentina).

Unidirectional valve

**Connecting pipes**

**collector bag**

**ruminal fistula**

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***Photo 4: Connecting the unidirectional valve with the micro fistula and the bag***

***collector***

***Foto5: One-way valve for anesthetic use allows directional rumen gases***

***To the bag***

C) Collection bags: polyethylene bags of 150 L capacity

Completely sealed with a flexible plastic outlet pipe attached to one of the walls.

(D) Connector tubes: silicone tubes were used as intermediaries between the

Different components described

**Inner fixation of the cannula**

**Insufflation of the inner sleeve in the rumen**

**10cm3 syringe**

**Pediatric tuboendotracheal N5,5**

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***Photo 6: Insufflation of the inner cuff with a syringe of the cannula microcanula***

Tube

endotracheal

**Intraruminal cannula**

Content

Ruminal

ruminant gases

Skin

Abdominal muscles

Parietal Peritoneum

Rumen Wall

Washer

Fixing

external

Sleeve

inflatable

Syringe 10 cm3

Valve

unidirectional

Peritoneal adhesion

Parietal and visceral (10 days)

***Figure 11: Schematic of the microcanula device installed inside the rumen***

***With one-way valve coupling***

**Assembly of the collection system:**

One end of the cannula is located in the gas accumulation sector

Produced in the rumen the other end is connected to the unidirectional valve by means of

A connector tube.

In turn, the unidirectional valve is continued and connected through an intermediary to

The collection bag.

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**System of collection of ruminal gases**

**collector bag**

**ruminal fistula**

**Unidirectional valve**

**Connecting pipes**

***Photo 7 Connection of the ruminal cannula to the collector tank with a valve***

***unidirectional***

**Collection System**

**Of ruminal gases**

CH4 + CO2

CH4 + CO2

Ruminant gases

CO2 + CH4 + others

Valve

unidirectional

***Figure 12: Scheme of the collection system of rumen gases via micro cannula valve***

***Unidirectional and collecting bag***

The collection bag is sucked in until it is completely emptied beforehand to eliminate all

The air that might contain

**Fixing collection system:**

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One end of the cannula is inserted through the fistula into the dorsal sac of the

Rumen.

The external washer is attached to the skin by means of contact cement, forming a

Sealing (without leakage).

In this way a system was obtained in which the gas could flow from the rumen to the

Bag, but not return

**Fixation of the bag of collection and storage of ruminal gases**

The collection bag is attached to the animal by means of a harness designed for this purpose

end

The bovine animal is placed in the trap and the gas collection device is installed.

Then sent to the morning grazing

From that moment the gas was collected for 24 hours

**Animal welfare**

One of the fundamental aspects in the process of obtaining ruminal gases is not

Generate pain or annoy animals

For this reason, I always work with animals, because of their temperament and docility

Allow work in comfort and safety for animals

The cattle were accustomed to be introduced in brete so much for the realization

Of the fistula to collect accumulated gases

The performance of the ruminal fistula performed under conditions of local anesthesia in the

Point of puncture avoiding any sign of pain to have the area under the effects of

local anesthetic

The process of internal healing that takes place in between the parietal peritoneum and the

Visceral peritoneum of the wall of the rumen dorsal sac is completed in 10 days during that

Period movements of installation and removal of the cannulas are avoided

Completed the healing process the animals did not manifest pain or discomfort

During the moment of introduction or withdrawal of the cannula

In order to establish a comparison the ruminal orifice is similar to what happened

With humans when they do a "piercing" situation in which 10 days later

Of the puncture point has no sensitivity

No signs of pain and / or discomfort are observed fulfilling their physiological activities

normally

If the cannula is withdrawn the closure communication hole in 24 hours closes

**Phase II**

**Purification of ruminal gases CO2 capture ySH2**

The gases produced inside the rumen have similarities in composition with the

Known as "biogas" produced by biodigesters

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The ruminal gases to be used as generators of caloric energy

Light or motor must first pass through a process of acid removal

Hydrogen sulfide (H2S) and carbon dioxide (CO2)

***Photo 8: CH4 concentration measurement equipment***

A variety of methods and processes are known for the capture of H2S CO2;

Some, very costly or unprofitable, that is why the idea of ​​applying a process is born,

Based on aqueous solutions of alkanolamines (also known as amines),

The ruminal gases, the product of the anaerobic fermentation of organic matter in the

Rumen, are composed of several gases in different

Average methane (20-25%), carbon dioxide (65-70%) and other trace gases

Such as hydrogen sulfide (5000 ppm), water vapor, nitrogen, among others.

For use in internal cycle engines, the

Acid components, such as CO2 and H2S, which cause corrosion problems in the

Interior of the engine and the decrease of the power in its output.

The method chosen to purify the ruminal gases in this work is one of the methods

Well known and used in the petrochemical industry, but their application was not known

In the ruminal gases nor the absorption behavior of monoethanolamine.

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***Photo 9: Purification of ruminal gas with bubbling in monoethanolamine 25%***

We work with a "bubbling method" through which intimate contact is made

Rumen gases with the amine solution, allowing the absorption of these gases. ) from

CO2 and S2H

An aqueous solution of 25% monoethanolamine was used, analyzing the

Absorption of the amines by the bubbling method, ie, without regenerating the amine

Saturated, only the solution was bottled and then discarded in an appropriate place.

For the determination of the ruminal gas composition, an analyzer

Portable gas meter for the determination of the concentration of ruminal gas before and

After the capture of CO2 and SH2 by the bubbling in 25% monoethylenamine

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Ruminant gases

CO2 75% CH4 24%

H2S traces

MEA

25%

Biomethane

95% CH4

Monoethanolamine

Bubble

Fixed active bicycle suction piston

Rumen gas collector bag

**Purification of**

**ruminal gases**

**To capture**

**CO2 and H2S**

**In MEA at 25%**

***Figure 13: Purification and compression of rumen gases***

To carry out the purification of ruminal biomethane by the bubbling method,

I used a bib-pump system that allowed the transfer of gases collected if gastp de

Energy

The ruminal gas was required to pass twice through a 25% solution of monoethanolamine

% To reach a concentration of 60 to 65% in the first pass and then 95 to

97% in the second

**Effect of presence of H2S**

The hydrogen sulphide in its gaseous state is part of the ruminal biogas, presenting

Corrosive properties against metallic parts if used for practical purposes in

Engines. H2S destroys non-ferrous metals or non-ferrous metal parts,

Such as pressure regulators, gas meters, valves and fittings. Corrosion

Induced by the presence of H2S occurs when the metal comes in contact with the H2S

And reacts forming iron sulfides and atomic hydrogen causing wear on the

Piece, obscuring its color and forming cracks in the surface

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**Phase III**

**Compression of purified ruminal gases**

**Mobilization and compression of ruminal gas by the use of energy**

**Mechanics produced by a bicycle.**

A cycling fan can easily give about 90 pedals per minute (1.5

Pedals per second). Stationary pedaling is not the same as en route. In

Movement on a road the rider has to overcome resistance to wind and friction

Of the surface by which a cyclist of about 70 kg is cycled that pedals between 10 and 20

Km / h consumes between 245 and 410 kcal / hour.

Starting from the principle that one of the most efficient machines to transmit the power

Human energy is the bicycle. Remember that when you ride a bicycle you will

Consume about 0.15 calories per gram of individual weight per kilometer,

The objective was to design in a simple and efficient form of pumping of ruminal gases

For its purification and compression using human energy by means of a

bicycle,

The bib pump is designed to

1) transfer the ruminal gases collected in a container on the back of the bovine

And directed into a container containing monoethanol amine for purification

Extracting Co2 and H2S

2) compress the biomethane to 95% of the purified ruminal gases in a container that

Store it and then be used in a practical way from the combustion in a kitchen

Their use in a refrigerator producing light or running a car

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***Picture 10: Bimini pump components***

The bike pump works in the same way as a motor pump (electric), with the

Difference that the driving force is not exercised with electric power, but with the feet.

An adult person can generate about 125-200 watts of power on a bicycle

For a period of one hour.

Therefore, it is important to choose a pump with similar power; An appropriate pump

Could be a 200-400 watt.

**Design of the system of mobilization and compression of rumen gases with a bicycle**

**fixed**

It is designed and developed a bike pump consisting of the following elements:

-1) A piston pump is a hydraulic pump movement therein That Generates

by movement of a piston. Each movement of the piston displaces in each

moving the same volume of fluid, Which is equal to the volume occupied by the piston

During the race itself.

-2) A gear system That Converts the rotational energy to bicycle

operating the pump,

- 3) That connect the pump hoses from the source and output, and

-4) A station Where the user pedalearía stationary bike.

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The operation of the system is based on the movement of the piston Pump That

details as Follows:

-1) Piston pump rotational energy ranges of the bicycle,

- 2) When the piston moves down, a void Which draws or pulls the water is created,

- 3) When the piston rises, the water is pushed out.

***Figure 14 Inner part of a piston pump*** .

The complete design shown in Figure 2 Wherein the coupling is performed

bicycle pump; Which for the following steps:

-4) Bicycle and pump welded and bolted to a common metal support,

5) - a strap or belt is fastened or Engages rear wheel of the bicycle and wheel

the bomb,

-6) Hose extends from the well or source to the pump inlet,

7) - A check valve on the basis of the source is used to allow the liquid to flow

only one direction.

-8) Stretch out the hose from the pump outlet to the Desired containment.

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**phase IV**

**Practical application of biomentano as energy source**

From purification to 95-97% methane and subsequent compression in a decanter to

12 bar pressure Proceeded to the practical Implementation and use in generation

Energy

Motive Power A car Chevrolet Corsa 2010 model Adapted for Use with gas

Natural gas CNG concentrated Whose tank installed in the trunk was closed valve

That prevented us the passage of commercial CNG gas

That was used flagon was installed on the roof of the car on a luggage rack

compression for methane at a pressure of 13 bars

***Figure 15 Sequence to Achieve energy use in driving a car***

A plastic pipe connection being established carrier flagon biomethane

installed on the car roof and the gas inlet site Where the gas is loaded into the

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The automobile service stations and Properly lit march was like

use the commercial CNG

**Photo 11: Attaching the bottle carrier biomethane in the luggage carrier**

**car**

**conclusions**

The proposal Described Makes available biomethane from collecting gases

Demonstrates bovine rumen and practical use ITS through a process

captures the CO2 purification and H2S Have biomethane to 95-97% of Achieving

Allowing power generation and purity Also Constituting a measure

mitigation to Achieve the reduction of ruminal methane Emissions

The harness used to Maintain the collection bag on the back of the animals PROVED

useful and not create discomfort in cattle after a period of adaptation

5 days

The method of producing a ruminal using an endotracheal tube microfistula

pediatric use is a simple practice and does not cause pain or discomfort to the animals

The developed technique PROVED to be efficient to collect ruminal gases

The purification method for CO2 capture sparging monoethanolamine

and H2S can be efficient in order to Obtain methane concentration in a pass 20

To 95-97% -25%

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The use of the bike pump allowed the mobilization of rumen gases Collected

to be purified through the bubbling of monoethanolamine to 25% and then a for

Carafe compression pressure up to 13 bar

- Construction of a bike-pump Contained In This document is Easily adaptable and

very practical,

The blue flame combustion is Obtained in a verifiable indicator of the high

ruminal quality purified and compressed gas as thermal energy generator

Carafe Incorporating the gas inlet via an adapter allowed

incorporation of bio methane combustion engine for operation

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With natural gas sweetening amines. delproceso simulation and sensitivity analysis

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Development of Biogas System for Using Compression The First TSME International

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Household

Ma. Fernanda Romero Cún Professional Training, Private Technical University of

Actuation Loja to pump water using mechanical energy

produced by a bicycle.

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