# Effective Utilization of Agricultural Waste – Review Paper

Kanjan Upadhyay
Professor
Chemical Engineering Department,
Ujjain engineering college ,Ujjain (MP).

Kumar Harshwardhan
M. Tech Scholar
Chemical Engineering Department,
Ujjain Engineering College , Ujjain (M.P.)

***Abstract-*** **Agricultural substances are those substances that are produce on earth with the change of seasons. Basically these substances are produce in the nature and are very important for survival of animals and human beings who are consumers. These substances are widely available on earth can be a good source of energy or can be converted into useful products. The waste generated from crop have a good potential to convert in energy in related energy sector. The waste produce from animal waste or from crop residues called biomass which have an interdependent relationship with ecosystem from production to disposal and has a physicochemical properties. The present paper deals with the research work carried out in the past related to conversion of biomass and agricultural waste. An attempt is carried out to increase the economic values of agricultural waste into useful product.**

***Keywords: Biomass, Unaerobic Digestion.***

## INTRODUCTION:-

Agricultural waste is the material obtained due to crop production or from plant growth. In the past this biomass and agricultural waste were either burnt or naturally converted into organic fertilizer under favourable condition. But now in these days biomass produced from agricultural waste are used to generate energy because it carries great potential to convert into energy. Since the biomass is available throughout the world in abundant quantity so it is necessary to use alternate energy resources to fulfill our needs of energy consumption. The effective utilization of agricultural waste is a good option to convert these waste in energy. For this efforts have been made and many more are under way, it requires guidelines concerning the utilization of agricultural biomass for energy purposes and optimal production. Production of energy from biomass can provide farmers with new prospects and possibilities to diversify agricultural activites. Some of these crops may compete for land and other resources with traditional crops, while other crops may be grown on marginal lands or even ecologically degraded areas and thus have a positive effect on the environment. In view of the circumstances described above, there has been growing interest in studies that present future energy scenarios and conversion of biomass into useful products. The primary aim of this paper is to analysis in detail the various application and research carried in the fields of biomass and forecast of the production potential of agricultural biomass. The detailed study includes the following factors scope of the forecasted consumption of renewable energy in terms of energy types (electrical energy, heat, automotive biofuels), energy potential of agriculture (sources of agricultural biomass, utilization structure of agricultural biomass, the volume of production of solid biomass, biogas and biofuels, cultivation area of energy crops) and barriers to the utilization of biomass. Biomass is one of the renewable resource that is found in nature in abundant quantity it may be used as one of the most energy resource and can be converted into more reformed resources. Utilization of agricultural waste is very important concern specially when the world scenario of energy demand gap is being reported. The resolution to mitigate this gap is use of biomass and its other utilization is being investigated so that it can be used as an alternative source of energy production as well as converting the biomass into some commercial products. Lot of work has been reported in the litrature regarding utilization of biomass some of the work conducted in this area are as follows :-

In the year (2016) Aeslina et al., studied the feasibility of utilizing the coffee waste in the production of bricks. The parameter of the study was cw (coffee waste) ratio and temperature. The properties like shrinking density and compressive strength were considered. In this methodology, control brick and three different percentage of coffee waste brick (CWB) (1%,3%,5%) were manufactured and fired at 1050°C. Apart from main properties like physical, shrinkage, density and compressive strength were reported and discussed additionally leaching of heavy metals from manufactured clay brick was tested by using toxicity characteristics leaching procedure. It was noted that with the addition of CW. the shrinkage increased linearly but still comply with minimum standard below 8% and good quality of brick was manufactured. Hence coffee waste can be utilized in the production of fire clay bricks with the different proportion of cw. in addition it gives alternate solutions on disposing the coffee waste. The cw could also have a potential low cost waste additive for production of bricks.

In the year (2016) gaurav et al., studied the utilization of waste sawdust for the removal of basic dye “methylene blue” that describes as methyl blue which has many adverse impact on photosynthesis in aquatic environment and many other complications. sawdust is a low cost agro waste and have tremendous capacity to absorb the dye on the surface. The study involves the comparison of dye removal capacity of raw saw dust and NAOH plus enzymatically treated sawdust Various parameters like substrate concentration, contact time and dye adsorption which having initial concentration of 100mg/L was known to increased for both

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 6 Issue 09, September - 2017

treated and untreated sawdust at 30°C and 120 rpm. Maximum adsorption observed at concentration of 2.5g % was 97.47% and 70% for treated and untreated sawdust respectively for contact time of 6h and initial concentration of 100mg/L. When adsorption property of sawdust was checked for different concentration of the dye concentration rate of adsorption was decreased. Maximum dye removal was noticed to be 99.16% and 85.54% for treated and untreated saw dust respectively for the dye concentration of 25 mg/L and substrate concentration of 2.5% at 30°C and 120 rpm.

In the year (2016) Shriganeshet al., studied properties of agricultural waste as soil stabilizer and found that agricultural waste in India is not disposed properly. The aim of this research was to utilize it in pure form hence ashes of these waste materials separately at 3%, 6%, 9%, 12% and 15 % were used. Tests such as CBR and standard proctor tests were conducted. The parameter of study was specific gravity (2.662), liquid limit(66), plastic limit(26.62), plasticity index(39.99), free well index(23.08), optimum moister content(26.11), maximum dry density (1.445). During milling of paddy about 78% of weight is received as rice broken rice and bran, rest 22% of the weight of paddy is received as husk .This husk is used as fuel in the rice mills to generate steam for the parboiling process. This husk contain about 75% organic volatile matter and the balance 25% of the weight of this husk is converted into ash during firing process, known as rice husk (RHA). This RHA in turn contains around 85% to 90% amorphous silica, hence there is a addition to these two agricultural waste serving the three benefits of safe disposal of wastes using as stabilizer and return of incomes on it.

In the year (2016) A appaiah et al., studied the feasibility of utilizing Wheat bran agricultural waste to produce bio-alcohol. It was observed that the production of alcohol from pentose sugar which is a sole constituent of wheat bran. Physical treatment like Particle size reduction of wheat bran along with chemical and enzymatic treatments, were studied for the production of bio-alcohol. Wheat bran of reduced particle size was treated with moist heat at 800°C, coupled with acid treatment produced total sugar with fermentable range. The parameter of study was size of wheat bran, thermal pretreatment, acid pretreatment, Estimation of total sugar. On fermentation with *Candida tropicalis* MTCC230 a maximum of 1.21g of bio-alcohol was produced, relatively higher than earlier study. Viscosity was subordinate for 1% acid treated wheat bran due to breakdown of polysaccharides into simple sugar which is accountable for viscosity. Limited fermentation is seen in sample of wheat bran extract treated with higher concentration of acid, when subjected to fermentation with *Candida tropicalis* MTCC230 resulting in low yield of bio-alcohol.

In the year (2015) Tay lay et al., studied the physical and chemical properties of coconut shell in asphalt mixture and its application in road construction. It was observed that it can also be used on x ray fluorescent scanning electron microscopy x-ray diffraction and besides that, coconut shell also categories as metal matrix composites with fly ash and rice husk which can rectify characteristics such as great precise strengths, precise modulus, good weather resistance and great dumping capacity contrast to unreinforced alloys. Coconut shell ash and rice husk also are the cheaper and low density reinforcement as solid waste by-product. Dried CS contains 33.61% cellulose, 36.51% lignin, 29.27% pentosans and 0.61% ash. CS has low ash content but high volatile matter, 65-75%. The water absorption of the CS is higher than usual aggregate, which is 24% compared to 0.5% Coconut shell ash can hold out working temperature of 1500°C besides CS is also more resistance against crushing, impact and abrasion compared to others conventional crushed granite aggregates. Coconut shell that can found in the market and the crushed coconut shell that normally used in the test. can be mixed with asphalt mixture directly for the experiment except water absorption test. CS has high water absorption ability because of its open structure containing many hydroxyl and acetyl group hence hemicelluloses can be partly soluble in water and hygroscopic. In order to reduce the water absorption ability of CS as the excessive content of water will weaken the structure of CS. Chemical treatment can optimize the interface of CS to reduce its hydrophilic properties. The most usual treatment for CS is by using Sodium Hydroxide (NaOH) as it can reduce the hydroxide compound in CS thus reduce absorption ability.

$$CS\text{-}OH + NaOH \Rightarrow CS\text{-}O\text{-}Na^{+} + H_2O$$

Besides that, some researchers have burnt CS into charcoal form and used as a filler to resist resistance to freezing, crushing and absorption. Hence it can be concluded that by using coconut shell in asphalt mixture has better potential than others raw materials to contribute in construction field.

In the year (2015) ghorade et al., studied the potential of organic farming and sustainable agricultural waste like banana peels which has becomes serious problem caused by its productions. It can be used in making organic fertilizer and also have a potential to developed to a commercial level. The organic waste from the banana peels is fermented by effective microorganism and molasses. This can be used as Fermented Organic Liquid. The municipality has utilized this liquid as a deodorizer and cleaning liquid. Furthermore this organic liquid can be used as fermented organic liquid fertilizer. It works through traditional practices of recycling farm-produced livestock manures, composting, and crop residue management.

In the year (2014) M Vikas et al., studied the effective utilization of Neem as natural absorbent in the treatment of Dairy Waste Water. It was observed that the consumption of large volumes of water and generation of organic compounds as liquid effluents are major environmental problems in milk processing industry. A large number of chemicals are used for the production of potable water and in the treatment of wastewater effluents. The adsorption process is one of the effective techniques and various natural adsorbents are widely used for removal of emerging pollutants in dairy wastewater. The use of natural adsorbents has been widely investigated as a replacement for current costly methods of removing pollutants from dairy effluent. The aim of this study is to contribute in the search for less expensive adsorbents and their utilization possibilities of various agricultural waste byproducts such as sugarcane bagasse, rice husk, oil palm shell, coconut shell, coconut husk for the elimination of pollutants from wastewater. The parameter of the study includes turbidity, pH , color etc. It was noted that at initial level the pH of effluent was reported as 10.5, which indicated the water is highly alkaline .After 1 hr the pH reduced to 10, after 2 hrs it became 9.8, after 3 hrs it was 9.5, after 4 hrs the pH recorded was 9.0 and after 24hrs the pH value was 8.2 which shows the effluent is quite lesser alkaline than initial level.

In the year (2014) M. nidzam et al., studied the utilization of agricultural waste in stabilizing of landfill soil. The main constituent of material was palm oil ash and rice husk ash as a sustainable substitute instead of using traditional Portland cement. Landfill soil on its own and combination with laterite clay soil were stabilized using POFA (Palm Oil Fuel Ash) or RHA either on its own or in combination with Lime or Portland Cement (PC). The traditional stabilizers of lime or Portland Cement (PC) were used as controls. It was observed that landfill soil combined with laterite clay (50:50) stabilized with 20% RHA:PC (50:50) and POFA:PC (50:50) recorded the highest values of compressive strength compared to the other compositions of stabilizers and soils. However, when the amount of POFA and RHA increased in the system the compressive strength values of the samples tends to increase. These results suggest technological, economic as well as environmental advantages of using POFA and RHA and similar industrial by-products to achieve sustainable infrastructure development with near zero industrial waste.

In the year (2014) R.balaji et al., studied the effective way to remove iron from drinking ground water with help of agricultural waste used as a natural adsorbents and area of study was typically associated in Chennai where the concentration of iron was 0.3mg/L. The removal of iron was calculated by using sugarcane bagasse and coconut coir selected as solid phase extra coir for removal total iron. It was noted that these products exhibits remarkable characteristics and ablity to remove total iron. The parameters such as effect of pH, adsorbent dosage, contact time, initial concentration etc were studied. The highest percentage removal of total iron was observed at coconut coir than sugarcane bagasse.

In the year (2014) Anil et al., studied the feasibility of utilizing fly ash and rice husk in stabilization of soil. Black cotton soil was mixed with fly ash at (5%, 10%, 15%, 20% and 25%) while Rice husk ash was treated with (10%, 15%, 20%,25% and 30%) and examined after 28 days of curing. It was observed that Liquid limit was reduced to 55% for (20% fly ash and 25% RHA mixed with soil sample. Plasticity index was reduced to86% for 20% Fly ash and 25% RHA mixed with soil, differential free swell reduced to 75% for 15% fly ash and 20% RHA mixed with soil, specific gravity reduced significantly as well.

In the year (2013) devendra et al., studied the use of lignocelluloses rich agricultural waste. Cellulases are capable of the extensive solubilization of highly ordered form of cellulose and are reported to be produced from well known microbial sources such as aerobic and anaerobic fungi (HANG and WOODAMS, 1994; ONSORI et al. 2005) and anaerobic fungus (CALZA, 1990).The cost of enzyme production can be significantly reduced if low value biological substrates like fruit processing waste are used.

In the year (2013) ankit et al., studied the agro waste as an innovative material in Indian context by using agro waste characteristics with clay or calcium bicarbonate. Groundnut husk, jute fibre, rice husk, rice staw, rice bale, saw dust, and coconut fibre and other fibrous material have been identified as most economically important wastes for building industry. It is estimated that in India nearly 700 million tonnes of organic waste is generated annually which is either burned or land filled. The large amount of the agro waste generated from the market area has created major environmental problems. Earthworms have ability to convert organic waste into valuable resources containing plant nutrients and organic matter, which are essential for maintaining soil productivity. The parameter of study includes density, average particle size, specific surface area, minerology Non crystalline Shape and texture Irregularity.

In the year Hasan (2013) et al., conducted studies on growth medium for lactobacillus species by fermentation. The commercial probiotics lactobacillus which is a friendly bacteria with the help of fermentation addition to the ability of probiotics strains to grow in pineapple waste was investigated. The parameters which affect the reaction rate of micro organism activity are temperature, pH, culture media. It was noted that pineapple wastes from these processing industries can be utilized to produce culture medium for cultivation of probiotics bacteria as compared to MRS (De Man, Rogosa and sharpe agar) medium which is an expensive medium for cultivating probiotics.

In the year (2013) Evnas et al., studied the use of pineapple waste to enrich nutrient by solid state fermentation. fungi A.niger and T.varide were used with animal feed and found that pineapple waste may be potential supplement which is acceptable and highly digestible. The enrichment by microbial fermentation of agro industrial waste to alleviate their nutritional problems has been proposed but the nutritional value of the subsequent feed for animal consumption has not been fully elucidated. Results show that fermentation of pineapple waste by solid state fermentation using the fungi A. niger and T. viride significantly ($P < 0.05$) enriches the nutrient content of the waste, particularly increasing the crude protein and ash content while lowering the crude fiber content.

In the year (2013) navdeep singh et al., studied the use of agricultural charcoal for power generation. The agricultural waste can be converted into fuel cakes and charcoal modified by destructive distillation process. Charcoal fuel as a energy source and can be classified according to their different calorific value. Based on availability of raw material using effective carboniser may help in the production of electricity.

In the year (2012) R.vidyalakshmi et al., studied the production of xanthan from agro-industrial waste, an attempt to synthecise xanthan. The agricultural waste potato peel was employed as carbon substrate in which x.citri produced high amount of xanthan. Xanthan are water soluble Exopolysaccharides produced by Xanthomonas species. These polysaccharides have much common application and normally produced in submerged fermentation by using different carbon sources. Solid state fermentation offers numerous advantages for the production of bulk chemicals and enzymes. The work was carried out to find the possibility of using agricultural waste as lower cost alternative substrates for xanthan production which is a widely used food additive.

In the year (2012) L.udayasimha et al., studied the possibility of sustainable waste management by growing mushroom on aerobically digested waste and agro waste residues. The digestive material along with agricultural residues such as coir pith, paddy straw and mushroom cultivation offers the opportunity to utilize renewable resources in the productions of edible protein rich food that sustained food security.

In the year (2012) D.jansirani et al., studied the production and utilization of vermicast using organic waste. The parameter for study includes vermicast production from decomposition of spent tea waste coconut coir and sugarcane bagasse.

In the year (2012) Igor sepelev et al., studied the possibility of utilizing potato peel waste produced in food production unit. In addition potato peel powder can be serve as a partial flour replacement without any significant change in sensory properties of material and in fermentation.

In the year (2011) Eng-cheong et al., studied the utilization of agricultural waste as a bio absorbent for the removal of dyes from aqueous solution. It was observed that sugarcane bagasses and modified rice hull can be used as a low cost material for removal of dyes. The test were performed on atomic force microscopy, batch and column studies. Results revealed that breakthrough was influent concentration, flow rate and bed height dependent.

In the year (2012) N. S. Grewal et al., studied the utilization of dry anaerobic fermentation although it has been used on practical scale by the farmers and used sites filled with manure and bedding as methane generators. No information on the kinetics or the economics of these systems exists. It was shown that the rate-of and efficiency-of conversion of a mixture of straw and dairy cow manure with initial solids at 25 % dry matter were close to control decay rates in a 10 % solid mixture. Studies of the effects of water content on the role of methane production on via mesophilic anaerobic fermentation were conducted. This study attempted to define the limits of moisture and chemicals had on hydrolysis reactions, the acid forming mechanisms and finally methane production. This study confirmed the potential of starting and controlling the dry anaerobic fermentation reaction.

In the year (2012) Akshaya et al., studied the effect of Polypropylene fibre on engineering characteristics of RHA-Lime stabilized expansive soil. 0.5-2% of polypropylene fibre was added at an increment of 0.5%. The optimum proportion of soil: RHA: Lime fibre was found to be 84.5: 10: 4:1.5.

In the year (2011) A.Jha et al., studied the performance and mechanism of dry anaerobic digestion process and method to treat high-solid content bio-wastes, to recover potential renewable energy and nutrient-rich fertilizer for sustainable solid waste management. The parameter of study was concentrations, volumetric organic loading rate, Ph, temperature, heat, retention time. Incomplete mixing and the accumulation of volatile fatty acids (VFAs) were observed.

In the year (2011) Niki komioti et al., studied the waste utilization of decentralized energy production. The work includes technology review and assessment, in order to assess the different technological solutions available in the EU and propose the most suitable ones for each country taking into account local characteristics and market conditions. Identification and assessment of legislative, institutional and administrative barriers to agricultural waste exploitation by identifying the chain of responsibility, the involved organisations and the principles of cooperation between all parties involved. Mapping of the potential of agricultural waste that can be exploited in a sustainable way, including types, quantities, regional distribution, current use, trends, etc. The overall project deals with the environmental degradation and atmosphere pollution caused by the inefficient use of agricultural residues.

In the year (2011) Manpreet kaur et al., studied the agricultural waste utilization in civil engineering and follows the strategy to reduce the cost of construction as well as increase the strength of material. A concrete mix of 1:2:4 was used while coconut shells were used to replace crushed granite by volume. Seventy two cubes were produced and the densities and compressive strengths were evaluated at 7 days, 14 days, 21 days and 28 days. The density and compressive strength of concrete reduced as the percentage replacement increased. Concrete produced by 20%, 30%, 40% and 50% and 100% replacement attained 28-day compressive strengths of 19.7 $N/mm^2$, 18.68 $N/mm^2$, 17.57 $N/mm^2$, 16.65 $N/mm^2$ and 9.29 $N/mm^2$; corresponding to 94%, 89%, 85%, 79.6% and 44.4% of the compressive strength of the control concrete. The results of the study showed that concrete produced by replacing 18.5% of the crushed granite by rice husk ash, sugarcane bagasse gives good result.

In the year (2010) H.bandara et al., studied the utilization of agricultural waste in a microbiological process. The utilization of the anaerobic digestion process in waste treatment has been mainly justified on sludge volume reduction, stabilization, production of a non-noxious, more acceptable product for final disposal. Anaerobic digestion as of sewage sludge does not achieve complete decomposition about 60 – 75 % reduction in volatile solids is generally achieved. Sludge fed to these digesters at about 5% to 10 % solids, thus the residual sludge is about 3% to 6 % solids which may undergo some treatment prior to disposal. The investigation examined the anaerobic digestion of animal wastes under relatively dry (solids concentrations greater than 20 %) conditions in a an effort to nullifies the problems of post digestion treatment of digester supernatant, solids concentration and dewatering prior to disposal, and thus enhance the economics of the overall process.

In the year (2010) Oriola et al, studied Groundnut shell ash stabilization of Black Cotton Soil. The stabilization of black cotton soil with groundnut shell ash was not attainable. However, it was found that groundnut shell ash shows progressive strength development with longer curing periods from the observations of the 7, 14 and 28 days cured unconfined compressive strength of specimens.

In the year (2009) Brook et al., conducted a study on soil stabilization with fly ash and rice husk ash. It was noted that the stress –strain behaviour of UCS showed that failure stress and strains increased by 106% and 50% respectively when fly ash content was increased from 0 to 25%. When the RHA content was increased from 0 to 12 %, UCS increased by 97% while CBR improved by 47%. It was therefore concluded that RHA content of 12% and fly ash content of 25% are recommended for blending into RHA for forming a swell reduction layer because of its satisfactory performance in Laboratory tests.

In the year (2008) W. Schiiferr et al., studied the utilization of agricultural waste in biogas technology. A feasibility study was conducted to provide facts and figures for decision makers to support the development of the economically and environmentally most promising biogas technology on-farm. The results may encourage on-farm biogas plant manufacturers to develop and market dry anaerobic digestion technology as a complementary technology. This technology may be a competitive alternative for farms using a dry manure chain or even for stockless farms. Up to now, farm scale dry digestion technology does not offer competitive advantages in biogas production compared to slurry based technology as far as only energy production is concerned. However, the results give an overview of existing technical solutions of farm-scale dry digestion plants. The results also show that the ideal technical solution is not invented yet. The development of new dry digestion prototype plants requires appropriate compensation for environmental benefits like closed energy and nutrient cycles to improve the economy of biogas production.

In the year (2008) Y. He, Y. Pang et al., studied the methods available to enhance biogas production from manure and straw. The parameter included are retention time, temperature, high temperature pre-treatment, addition of trace elements, addition of surface active elements, addition of enzymes, addition of bacteria, co-digestion of manure with straw and co-digestion of manure with straw pre-treated with fungi. Methane yields of 380 L/kg volatile solids (75 % energy recovery) can be obtained with mixtures of manure and straw and long retention times (120 days). High solids digestion of cattle manure with long retention times in family-size digesters gave methane yields of 230 L/kg volatile solids.

In the year (2007) S. ojolo et al., studied the coal and kitchen wastes which is used for biogas production. 3 kg quantity of cow waste mixed with 9L of water the mixer was loaded in 3 waste reactors. It was concluded that the waste can be managed through standard conversion volume into biogas which is a source of income generation for industrial as well as house hold purposes.

In the year (2007) Champagne et.al., studied the production of Bioethanol from Agricultural Waste Residues. The physical characteristics of Ethanol-blended gasolines which have the potential to contribute significantly to emission reductions. Ethanol is derived from biologically renewable resources and can be employed to replace octane enhancers and aromatic hydrocarbons or oxygenates. The ethanol production industry comprised mainly of small-scale plants producing ethanol primarily from agricultural crops as feedstock. The research aims in evaluating enzyme based biomass to ethanol conversion process.

In the year (2006) Isci et.al., studied the utilization of waste material from cotton farming and from mustard farming in the production of biogas and briquettes. Cotton waste can be used in biogas production by treating it anaerobically. Approximately 65, 86 and 78 ml $CH_4$ were produced in 23 days from 1 g of cotton stalks, cotton seed hull and cotton oil cake in the presence of basal medium (BM), respectively. BM supplementation had an important positive effect on the production of biogas. Mustard sticks and husk are sold to brick industries by all the farmers who cultivate it (100.00), 90.19 % farmers stored it for future use, percent 73.52 % used it for burning in chulha and only 16.66 % farmers use it for composting. A profitable way of managing mustard sticks is chipping and composting or feeding to animals after treating with ammonia. Another important material which can be made from mustard sticks are briquettes. Mustard stalk, mixed waste of tree leaves and grasses in 3:1 proportion and wood waste along with three organic binding materials (molasses, press mud and distillers dry grain) with varying concentration of 5, 10, 15 and 20% be used for preparing briquettes. Press mud was is a better binding agent, followed by distiller's dry grain and molasses.

In the year (2003) Dellepiane et al., studied the sugarcane waste used in an anaerobic digestion process. The mixture of different biomaterials are gradually digested by bacteria. The parameter of study was the rate of biogas production from digestion of organic waste, relative proportion of the components of the digesting materials and the number of existing bacteria in the slurry. It was observed that biomass with some percentage of livestock manure, i.e. cattle manure can increase methane yield by increasing bacterial diversities and reducing inhibition of methanogenesis.

In the year (2001) Andrade et al., studied the effectiveness of conversion of horticulture waste into useful products. The parameter of study includes moisture content, bulk density, compression ratio and compressive strength desired for better utilization and safe handling. Damaged or spoiled fruits and vegetables, dead plants, branches, leaves and unsold fruits and vegetables are the horticultural wastes. Among these damaged fruits and vegetables are turned into compost/vermicompost or fed to animals by 70.31 % of farmers. The dead plants branches and leaves were fed to animals. Value added products can be made from surplus fruits and vegetables and then sold in market this will not only help the farmers avoid wastage but to earn more.

In the year (2002) D.l. Rinker et al., studied the effective use of mushroom species in soil stabilization. Soil mixed with agriculture or landscape trades to enrich soil as a casing material in the cultivation of subsequent *Agaricus* crops, in vermiculture as a growing medium, in wetlands for remediation of contaminated water, in stabilizing severely disturbed soils, in the bio-remediation of contaminated soils, as a bedding for animals, as an animal feed, and to control plant diseases. Spent substrate from other mushroom species has found acceptance as food for animals, as ingredients in the cultivation of other mushroom species, as fuel, as a medium for vermiculture, to enrich soils, and as a matrix for bio-remediation.

In the year (1999) G. M. Wong-Chong et al., studied the mechanism of dry fermentation to generate energy with communal and agricultural organic waste and biomass. Mixed with substrates from human origin such as yellow water (urine), brown water (faeces, night soil) and to a lesser extent grey water, the aim of a hygienic treatment and additional fertilizer recovery can be realized. Up until now, biogas technology mainly concentrated on "wet fermentation" of agricultural and communal bio-waste as well as sewage sludge, the dry fermentation process can produce methane from biomass, which is not liquid, and in a mixture night soil collected from dry toilette systems. The one staged batch process needs no mixing of biomass during fermentation and no adding of water or liquid compounds, as it is necessary in conventional wet fermentation systems. The usual stirring and pumping do not works well in batch dry fermentation systems. It is especially suited for application in semiarid climates as the water consumption in the process is very low compared to conventional anaerobic digestion systems and can be recovered from the ecological sanitation system .

In the year (1999) H. N. Chanakya et al., studied the decomposition and gas production pattern of unprocessed biomass feed stocks representing annual weeds, leaf litter, agro-residues and market wastes were monitored in the laboratory study. It was observed that Solid phase fermentation was effected with a weekly fed biomass bed sprinkled twice daily with recycled fermented liquid to initiate and sustain biogas production from the decomposing biomass bed. Fomenters were fed from the top with gradually increasing feed rates to determine maximum feed rates sustainable. During decomposition, bulky biomass feed stocks underwent compaction and obviated the need for a pretreatment step. Bulk densities rose manifold to reach between 150±350 g l-1 within 20 days. A higher decomposition rate, process optimization and use of pre-compacted feed stocks have the potential to increase the feed rates (0.96±1.93 g TS -11-days), quantity of feedstock held in the reactor as well as gas production rates. The current gas production rates and space economy in these fomenters compare well with Indian cattle dung fomenters (0.3±0.5 l l-days).

In the year (1988) Annimari et al., studied the feasibility of utilizing energy crops and crop residues in methane production through anaerobic digestion. Crop residues were screened for their suitability for methane production, and the effects of harvest time and storage on the methane potential of crops was evaluated. Co-digestion of energy crops and crop residues with cow manure, as well as digestion of energy crops alone in batch leach bed reactors with and without a second stage upflow anaerobic sludge blanket. Storing without additives resulted in minor losses (0–13 %) in the methane potential of sugar beet tops but more substantial losses (17–39 %) in the methane potential of grass, while ensiling with additives was shown to have potential in improving the methane potentials of these substrates 19 % to 22 %. In semi-continuously fed laboratory continuously stirred tank reactors (CSTRs) co-digestion of manure and crops was shown feasible with feedstock VS containing up to 40 % of crops. The highest specific methane yields of 0.268, 0.229 and 0.213$m^3CH_4$ kg-L VS added in co-digestion of cow manure with grass, sugar beet tops and straw, respectively, were obtained with 30 % of crop in the feedstock, corresponding to 85 – 105 % of the methane potential in the substrates as determined by batch assays.

In the year (1986) H Singh et al., studied the utilization of rice husk agricultural waste. The waste has high heat potential. Less than 20% of rice straw is used as cattle feed, bedding and for paper and cardboard production. A major portion of it is burnt in the fields to make room for the next crop. The shortage of coal has induced the users to use husk in furnaces, brick kilns, as a packing material to protect eggs, porcelain wares, fragile structures from damage, in making insulation boards etc. Considering its utility, a study is conducted to explain the usefulness of this practically no cost fuel for generation of power.

In the year (1983) W. J. Oosterkamp et al., studied the utilization of agricultural waste for energy production. Organic waste that emits biogas or greenhouse gases that contribute to the global warming effect hence to utilize these waste for power production is a "cleaner" solution than open-field burning. It was found that municipal solid wastes (MSW) generated in increasing quantities are major source of waste, biogas can be harvested and used for electricity generation. In the process, the residual digestate can be processed into valuable fertilizer or soil conditioner.

In the year (1976) Jewell et al., studied the utilization of agricultural residues in conversion of methane. The parameter of study includes temperature, the amount and type of inoculum, buffer requirements, compaction, and pre treatment to control the initial available organic components that create pH problems. A pilot-scale reactor operation on corn stover at a temperature of $550^0$C , with 25% initial total solids, a seed-to-feed ratio of 2.5%, and a buffer-to-feed ratio of 8% achieved 33% total volatile solids destruction in 60 days. It was observed that volumetric biogas yields from this unit were greater than 1 vol/vol day for 12 days, and greater than 0.5 vol/vol day for 32 days, at a substrate density of 169 kg/m.

In the year (1975) Youn W. Han et al., studied the biogas yield of rice straw during anaerobic digestion can be substantially increased through solid-state sodium hydroxide (NaOH) pretreatment. This study was conducted to explore the mechanisms of biogas yield enhancement. The chemical compositions of the pretreated rice straw were first analyzed. Fourier transform infrared (FTIR), hydrogen-1 nuclear magnetic resonance spectroscopy (1H NMR), X-ray diffraction (XRD), and gas permeation chromatography (GPC) were then used to investigate the changes of chemical structures and physical characteristics of lignin, hemicellulose, and cellulose. The results showed that the biogas yield of 6 % NaOH-treated rice straw was increased by 27.3 - 64.5 %. The enhancement of the biogas yield was attributed to the improvement of biodegradability of the rice straw through NaOH pretreatment. Degradation of 16.4 % cellulose, 36.8 % hemicellulose, and 28.4 % lignin was observed. The ester bond of lignin-carbohydrate complexes (LCCs) was destroyed through the hydrolysis reaction, releasing more cellulose for biogas production. The linkages of inter-units and the functional groups of lignin, cellulose, and hemicellulose were either broken down or destroyed, leading to significant changes of chemical structures. The original lignin with a large molecular weight and three-dimensional network structure became one with a small molecular weight and linear structure after NaOH pretreatment.

## CONCLUSION

As seen from the research literature related to the utilization of biomass and agricultural waste, newer development in technology in process development and in product development is necessary to increase the economic values of products. As seen from the literature number of uses of biomass is being observed in the manufacture of brick making, as a filler in asphalt mixing, as an adsorbent in biogas production etc. More conversion of this waste requires more research and renovation in the existing technologies.

## REFERENCES-

(1) Aeslina Abdul Kadir, Hermawati Hinta and Noor Amira Sarani ,Department of Water and Environmental Engineering, Faculty of Civil and Environmental Engineering, Batu Pahat Johor, Malaysia, ISSN 1819-6608
(2) More Bhikhu**1** & Shah Gaurav Ph. D. Research Scholar, Dept. of Biotechnology, V.N.S.G.U., Surat. Assistant Professor, Dept. of Biotechnology, V.N.S.G.U.,Surat. Imperial Journal of Interdisciplinary Research (IJIR)Vol-2, Issue-10, 2016 ISSN: 2454-1362
(3) Shriganesh s.shinde M.E. Student, Government college of Engineering, Aurangabad., G.K patil Associate Professor, Government College of Engineering, Aurangabad. ISSN-2278621X
(4) Ashwini Devi C K, Anu Appaiah, K A, Umapathi and Sourav Kumar Flour Milling and Baking Technology, Central Instrumentation Facility and Services Food Microbiology CSIR-Central food Technological research Institute Mysore. International Journal of Engineering Research & Technology (IJERT) ISSN-2278-0181.
(5) Tay Lay Tinga, Ramadhansyah Putra Jayaa, Norhidayah Abdul Hassana, Haryati Yaacoba, Dewi Sri Jayantib, Mohd Azreen Mohd Ariffinc 78: 4 (2016) 85–89 | www.jurnalteknologi.utm.my | eISSN 2180–3722.
(6) GHORADE I.B., JADHAVAR V.R., POTADAR V.R AND PATIL S.S Department of Environmental Science Dr. Babasabhe Ambedkar Marahtwada University, Aurangabad (India). Indian Streams Research Journal Vol - 1, ISSUE - IX October 2011 ISSN:-2230-7850.
(7) Malik Vikas, Upadhyay Kanjan, Malik Bhawna M. Tech. Dept. of Chemical Engineering,Ujjain Engineering college, Ujjain, M.P., India Associate Professor, Dept. of Chemical Engineering, Ujjain Engineering College, Ujjain (M.P.), India Dept. of Biotechnology, Govt. Madhav Science College, Ujjain M.P., India ISSN: 2278-0181.
(8) Mohamad Nidzam Rahmat1, Muhammad Redzwan Raffe , Norsalisma Ismail Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, 40450 Shah Alam. Selangor. Malaysia .
(9) R. Balaji, S. Sasikala, G. Muthuraman University of Madras, Department of Chemistry, Presidency College, Chennai-600 005, India. ISSN-2277-3754.
(10) Anil Kumar and Sudhanshu Singh. (2014). Laboratory Study On Soil Stabilization Using Fly Ash And Rice Husk Ash. IJRET: International Journal of Research in Engineering and Technology, 348-350.
(11) Devendra KUMAR , Kaushlesh K. YADAV1, Munna SINGH, Neelima GARG Department of Botany, Lucknow University, Lucknow-226007, India Division of Post Harvest Management, Central Institute for Subtropical Horticulture, Lucknow – 227 107Research Journal of Agricultural Science, 44 , 2012.
(12) Mr Ankit N. Ptela Mr Sanjay Salla Department, Prof. Jayeshkumar B.V.M. Engineering College Vallabh vidyanagar-Gujarat-INDIA,ISSN-22278179
(13) HASSAN PYAR, MIN-TZE LIONG AND K.K PEH1 School of Pharmaceutical sciences, School of Industrial Technology, Universiti Sains Malaysia, Minden, 11800 Penang, Malaysia, Int J Pharm Pharm Sci, Vol 6, Issue 1, 142-145.
(14) Evans Otieno Omwango, Eliud Nyaga Mwaniki Njagi, George Owino Orinda and Ruth Nduta Wanjau Department of Natural Sciences, Mount Kenya University ISSN 1684-5315 ©2013.
(15) Navdeep Singh, Harshdeep Singh, Sewa Singh INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME, ISSN 2277-8616.
(16) R. Vidhyalakshmi , C. Vallinachiyar, R. Radhika Department of Biotechnology, Sathyabama University, Rajiv Gandhi salai, Chennai-600119, India Department of Biotechnology, Sathyabama University, India Department of Biotechnology, University of Madras Vidhyalakshmi et al, J Adv Scient Res, 2012, 3(2): 56-59.
(17) Dr.L.Udayasimha1, Y.C.Vijayalakshmi2 1, 2Dept of Environmental Engineering, BMS College of Engineering, Bangalore, India.
(18) Jansirani, D., Nivethitha, S. and Singh, M. V. P. 2012. Production and utilization of vermicast using organic wastes and its impact on Trogonella foenum and Phaselous aureus. International J. Research in Biological Science. 2(4): 287-289.
(19) Igor Sepelev, Ruta Galoburda Latvia University of Agriculture, RESEARCH FOR RURAL DEV ELOPMENT 2015.
(20) Eng-Cheong Khoo,and Siew-Teng Ong Department of Science, Faculty of Engineering and Science, Universiti Tunku Abdul Rahman, Jln Genting Kelang, Setapak, 53300 Kuala Lumpur, Malaysia. Department of Chemical Science, Faculty of Science, Universiti Tunku Abdul Rahman, Jln Universiti, Bandar Barat, 31900 Kampar, Perak, Malaysia.
(21) N. S. Grewal, B. S. Sohal, and Singh Malwinder “Paddy straw as a source of Energy”, Department of Civil Engineering, PAU, Ludhiana, India.
(22) Akshaya Kumar .S. (2012). Effect of Polypropylene Fiber on Engineering Properties of Rice Husk Ash – Lime Stabilized Expansive Soil. The Electronic Journal of Geotechnical Engineering 17,651,658-659.
(23) (23) Ajay Kumar Jha, Jianzheng Li, Loring Nies, and Liguo Zhang, Research Advances in dry anaerobic digestion process of solid organic wastes, African Journal of Biotechnology 10/65 (2011) 14242 - 1424253.
(24) Niki Komioti, Kostas Batos, Nafsika Zevgolis, Sotiris Fragkoulis EXERGIA S.A., ENERGY & ENVIRONMENT CONSULTANTS.
(25) Manpreet Kaur and Jaspal Singh,Department of Civil Engineering, Punjab Agricultural University, Ludhiana, INDIA Environmental Sustainability:Concepts, Principles, Evidences and Innovations - ISBN: 978-93-83083-75-6.

(26) H. M. C. K. Bbandara, K. D. N weerasinghe, G. Y. Jayasinghe, “Application of biogas technology as a renewable energy source andenvironmental friendly techniqueto manage solid waste”, Faculty of Agriculture, University of Ruhuna, Srilanka, 1-10.
(27) Oriola, F. and Moses, G. (2010) “Groundnut Shell Ash Stabilization of Black Cotton Soil,” Electronic Journal of Geotechnical Engineering, 15(E), 415-428.
(28) Brooks, R. M. (2009). Soil stabilization with flyash and rice husk ash. International journal of research and reviews in applied sciences.
(29) Winfried Schiiferr, MarjaLehtor and Frederick Teye “Dry anaerobic digestion of organic Residues on-farm- a feasibility study”, Agrifood Research Finland, Plant Production Research (V akola).
(30) W. J. Oosterkamp “Enhancement of biogas production from straw and manure”, Anannotated bibliography, Waste and Biomass Oosterkamp Valorisation Oosterkamp Oosterbeek Octooien, Netherlands.
(31) S.J. Ojolo,S.A. Oke, K. Animasahun, B.K. Adesuyi Department of Mechanical Engineering, University of Lagos,Lagos, Nigeria Iran. J. Environ. Health. Sci. Eng., 2007, Vol. 4, No. 4, pp. 223-228.
(32) Champagne P (2007) Feasibility of producing bio-ethanol from waste residues: a Canadian perspective feasibility of producing bio-ethanol.
(33) A. Iscia, G.N. Demirerb,Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, IA 50010, USA Department of Environmental Engineering, Middle East Technical University, 06531 Ankara, Turkey. A. Isci, G.N. Demirer / Renewable Energy 32 (2007) 750.
(34) Dellepiane, D., B. Bosio and E. Arato. 2003. Clean energy from sugarcane waste: feasibility study of an innovative application of bagasse and barbojo. Journal of Power Sources 122 (1): 47-56.
(35) Andrade, A.M Duarte, A.P.C Belgacem, M.N Munaro, E.R. The Production of handmade papers with mixtures of recycled fibers and virgin fibers of bamboo (Dendrocalamus giganteus) and sugar-cane bagasse (Saccharum officinarum) In: Floresta-e-Ambiente, 2001.
(36) D. L. Rinker et al. Mushroom World 8:71, 1997.
(37) G. M. Wong-Chong “Dry Anaerobic Digestion”, Energy, Agriculture and Waste Management (1999) 361 -371.
(38) H. N. Chanakya, K. G. Srikumar, V. Anand, J. Modak and K. S. Jagadish “Fermentation properties of agro-residues, leaf biomass and urban market garbage in a solid phase biogas fermenter” Biomass and Bioenergy 16 (1999) 417-429.
(39) Lehtomäki, Annimari Biogas production from energy crops and crop residues Jyväskylä: University of Jyväskylä, 2006, 91 p. (Jyväskylä Studies in Biological and Environmental Science, ISSN 1456–9701; 163).
(40) H. Singh, and K. S. Singh. “Paddy wastes for power generation. Irrigation and Power” (1986) 195-198.
(41) W. J. Oosterkamp “Enhancement of biogas production from straw and manure”, Anannotated bibliogr s.aphy, Waste and Biomass Oosterkamp Valorisation Oosterkamp Oosterbeek Octooien, Netherland.
(42) W. J. Jewell, R. M. Kabrick, S. Dell’orto and K. J. Fanfoni “Low cost approach to methane generation, storage and utilization from crop and animal residues”, Presented at the American Institute of Chemical Engineers Symposium “Biotechnology in Energy Production” Chicago, Illinois (1980) 1-22.