Influence of Parameters in Coal Water Slurry Mixing used for Gasification in Power Plant

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***Abstract:** This research analyses, updates and extends the concept of agitation used in mixing energy efficient systems. It also focuses on stirring processes that specifically affect solid-liquid particulate phases that are permitted in automated mechanical mixing vessels which is jacketed The major principle points of agitation utilizing mixed vessels is to keep up adjusted amounts of substances in various stages dependent on concentration. In situations where dissolvable solids are blended, stirrers are utilized to expand communication between the solid crystals and continue a strategic distance from lopsided gathering at a certain point. Therefore, this evaluate article is to fundamentally examine the various parts of past research works revealed in the field of solid-fluid strong blending.*

***Keywords:** Agitation, Mechanical Stirred Vessel, Solid-liquid Particles, Suspension of Solids*

I. INTRODUCTION

Fossil-based powers, such as fuel-liquid, vaporous petroleum and gas, typically meet the world's core demands. Among the oil-based commodities, coal is the fundamental resource of need for different nations, is modified by numerous developments to warm and electric power for our bit by bit life pre-necessities. Among the oil backups, coal has its own preferences as it meets about 60 percent of the needs of business centrality, and about 70 percent of India's power flows from coal Rao et al.[1] Watanabe and Otaka, Kajitani et al. [2],[3] Thermal power plants with the execution of the Coal Gasification Combined Cycle are being developed around the world to use coal even more beneficially and perfectly

IGCC is an innovative development in the electric power cycle that blends existing coal gasification with gas turbine and developments in the vapor fuel era. In a gas turbine, fuel gas transmitted by a gasifier is cleaned up and consumed to generate electrical power. Warmth recovered from the fumes of the hot turbine generates steam that activates a generator of steam turbines to transmit increasingly imperative power. IGCC power plants are naturally friendly and they are low in waste.

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Water consumption is lower than standard coal – a period of time because gas turbine units do not need cooling water – particularly in areas where water is needed. Due to their high capacity, less coal is used per megawatt-hour of yield which causes IGCC power plants to transmit less carbon dioxide to nature, an unusual environmental change concerns at this time. Comparatively less coal use pushes junk or slag needs if there is no demand for such products Hurst et al. [4]

Coal gasification is the way to turn over coal into a gas by combining steam and oxygen under heat The coal is stored in a container that is pressurized at high temperatures nearby steam and a small oxygen content to create a fire The gas is known as blend gas or syngas, which contains carbon monoxide which hydrogen in general The gas is cooled and bad elements are stripped, for example, of carbon dioxide and sulfur. The gas can be used in gas turbines as a fuel for steam, or the hydrogen can be combusted in turbines to transfer electricity. While being arranged the gas can also be organized and assembled into an invention or liquid fuel Kristiansen et al.[5]. The mixture of the form, measurement, design and extent of the particulates along with the chance of transporting liquid selects the properties of the slurry. The slurries can be divided thoroughly into the two forms of non-settling or settling. Non-settling slurries combine remarkably fine particles that can form stable homogeneous mixtures with an extended, transparent consistency. For example, settling slurries integrate coal-water mixture with coarser particles and will when all is said in finished structure. The basic bit of CWS fuel is that it transmits less toxins, such as garbage, SO_2 and NO_2 during start-up than coal fuel, As its junk content is lower than 7percent wt by and high. For the most part, sulfur content is lower than 0.5 percent light fire temperature is lower than pounded coal by 150-200 ° C. Coal water slurry can be treated in tanks, circulated via pipes, atomized and ate like fluid fuel, therefore it is a suitable replacement for the extensive fluid and fluid used in gasifiers. Jun Cheng et al. [6].

The section above deals with the uses of slurry carbon and coal water. The novelty of this analysis paper describing parameters in the coal gasification process to produce thermal energy from power plants.The following sections primarily discuss the effects of parameters such as tank size, impeller size, water volume, impeller and tank diameter ratio, clearance ratio, and tank diameter. From the study of work by various researchers based mainly on coal rather than coal water slurry future work mainly focused and the parameters stated in sections II, III.

II. PREPARATION OF COAL-LIQUID MIXTURES

Coal-liquid mixtures have been tested for more than a century and attempts have also been made to use the fuel in submarines during World War I. For energy and liquid spending the importance has increased..Too much work has been undertaken by the United States to flush out dwindling liquid assets . The cost difference between energy and fluid was too low to even speak of increasingly motivating change by increasing the carbon content, the need to familiarize exceptional substances with improvements. Nevertheless, numerous studies during the 1970s revealed the basic reasonableness of these blends used in daily fluid up to 315 MW for research purposes. Instead of Meth carbon being replaced by coal, it has been proposed for transport and various uses. There are several benefits, as coal dissolves and transports in a liquid that itself needs to be pointed free flow in a tank. Mixing a coal in a steady suspension even frees mineral issue; Coal water mixing structures typically connect a gain stage. Clearly, the mixture remains highly skilled and continuous, depending on the particle density, up to 75percent of granulated particles Bienstock,d et al [7]. Coal particle-fluid mixtures usually contain coal as a slurry form by changing various parameters Coal should be pulverized because fuel techniques seem ideal for the preparation of coal water mixing, it would seem ideal to create a completely equal size distribution of the coal surface in order to achieve maximum solids charging the suspension. When mixing coal water, the carbon surface should be dry and mixed with oil, or even coarse coal should be mixed with damp fluid. Coal-liquid mixtures are most likely to be used in coal-fired boilers converted into oil or in oil boilers that can easily conform to each carbon-liquid mixture without any output loss. Specifications of the Coal-Liquid Mixture Suspension must be stable for long stretches, so that it shifts and functions like gasoline. The viscosity must below to any pumping fee. The proportion of mineral matter shall be low if the mixture is to be used as an oil replacement. The fuel must be burned as pollution-free as possible. The suspension shall be non-abrasive and coagulant. Ercolani,d et al [8].

A.System of blending coal particles and liquids:

Agitation for systematic mixture of carbon pellets withnon-settling solvent in the bottom of a tank. Agitation was a process introduced in the 1950s by the foundations, blending to minimize homogeneity in order to produce the desired effect. The importance of mass transfer, the reaction and chemical properties is stressed in the homogeneity and the effect on thermal properties. The above improvements can be made at once or under specific circumstances. The core reasons for promoting mixed vessel schemes to preserve equilibrium relative uniformity based on fixation levels in various stages. In cases where dissolvable strong particles are mixed, the distance from the unequal aggregate is maintained for expanding the interaction between the particles. Flow streams in stirring vessels are known as chaotic, volatile and impossible to determine; therefore it is a difficult challenge to produce a homogeneous blend. Standardized mixing substance proportions are important if the expensive pesticides, fertilizers and other mixing agents are to be used efficiently and sustainable in farming applications. The need to develop mixing processes in the Disturbed Tank Reactor has led multiple studies to investigate the diverse local hydrodynamic flows. Agitation may also improve the mass transfer rate by combining a miscible solution (or other material) with a liquid solvent. In this article fomentation is also constantly challenged thatthe key emphasis on a good interface and the course of action should be retained. Robert S.Brodkey and Harry C.Hershey[10] The tanks containing liquids and one or more impellers which supply the shear flow, are usually discussed about the agitation equipment, a motor or some other method of driving the impeller and, generally speaking, a wall baffles that allows for higher input power. Wall baffles are linear shapes connected tothe inner walls of the tank.The best implementation of the arrangement involves the physical elements of the fomenting device as seen in Figure 1. Table 1 shows Suzanne M. Kresta [11] displays different parameters pertaining to Figure 1.

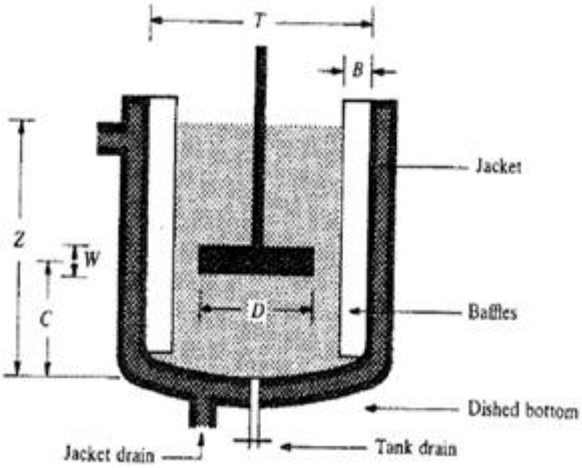


Fig. 1.Agitation tank with baffles, jacket, and dished bottom

Table 1: Nomenclature of Agitation

Symbols	Nomenclature
B	Baffle plate width
C	Clearance between from bottom tank to impeller
D	Diameter impeller
T	Internal vessel diameter
W	thickness of the impeller
Z	Height of the liquid in the vessel

III. PARAMETERS OF AGITATION EQUIPMENT INFLUENCING ON SOLID LIQUID-SUSPENSION

Edward L. Paul. [9] The essential solid-liquid properties and the parameters fitted to regulate a solid suspension are discussed briefly below in liquid material

Agitation conditions

a. Speed of impeller

b. Power of impeller

Tank and Impeller parameters.

a. Inside diameter of Mechanical Jacketed vessel

b. Base type of vessel

C.Model and parameters of impeller

d. impeller diameter

e. Distance from the bottom to impeller

f. Baffle, baffle model number

B. Impact clearance between the impeller and mixer tank

The impeller clearance has a significant impact on a good suspension. As the impeller operates close to the base of the vessel. In this case, the ions stuck just below the propeller at the base of the tank are moving for the corners. This center to corner motion faces minimal resistance while, at the same time, it accumulates enough energy to carry the particles into suspension after sliding between the wall and the stirrer tank base intersection. The stationary region under the impeller decreases and thus more stable particles are produced by increasing the off-bottom clearance of the impeller. In comparison, fluid transport of solid objects reduces and the impeller has to increase speed to cause the objects to pass to the corner of the vessel.

Zwietering[12] was found, as the off-bottom impeller was limited to the tank diameter ratio, to the overall minimum agitation speed (Njs) for the burst, the flat paddock and the vane disc turbine was to be lower. Therefore, the off-bottom clearing impeller cannot be conveyed within a control legislation context through a graphical review of the experimental content. The clearance and tank ratio as a constant parameter in his work was considered more acceptable. Similarly, Chudacek[13] has also given findings on the adequacy of regular distribution to determine the effect of clearance in the general region measured. The impeller shall be installed with minimum clearance for maximum suspension capabilities as determined by either the height of the solids fixed to the tank in each case or by the configuration of the given tank. Apart from high concentration of finer and uncouth slurries conceived (24.4 vol percent) base tank. In the last instance, the optimal clearance was 33percent the diameter of the container. Furthermore, the rotor clearance was observed to have a significant impact on only theN_{Js} for rushton disk turbines. Conti et al. [14] and Chapman et al. [15].Yianneskiset al. [16] Noted that the impeller diameter and tank diameter proportions took around 0.33, with alower clearance and an increased inclination of a single smooth, circular disk impeller to the horizontal impeller.

Gray.D.J [17] investigated the effect of impeller clearance on both suspension speed and energy usage in liquid solid systems. In the case of the rushton impeller, the clearance of the impeller in which the flow transfer was measured and reported as the clearance ratio and the tank diameter was 0.18 and 0.22 for the impeller ratio and 5 and 8 for the impeller distance, respectively. For axial flow it transfers at clearance equal to 0.35 times the diameter of the tank, it was also claimed that the flow pattern in the flat base tank is the same as the number 8 pattern. And the effect of the throttle clearance on the power dissipation in the just-suspended condition (Pjs) in the lower flat bottom tank region was also studied.

Myers et al [19] find that the axial flow impulses within the range of diameter and diameter of the impeller are different from the size of the impeller. Pjs' exponential dependence on C/ T has also been discovered as obtained, as Pjs are directly connected to exp (a C / T).A = 1.2, a = 0.35 for "single-eight" mode, and a = 5.3 for "dual-eight" (C / T > 0.35) were found. Similar values for the 0,102 m radial flow impeller were found by the reviewer stated that the 'single eight' (C/T <0.17) and the 'double-eight' method (C / T > 0.17) were a '= 1.2.' This final value is a = 5.3 value for Flat Paddle blade impeller, which Weisman and Efferding [58] found.

Raghavaraoet al. [19] pointed out that the importance of the critical impeller speed decreases with any impeller with decreased rotor clearance. At the other hand, the degree of reduction for disk turbines and pitched blade upstream turbines is more widespread than for pitched-blade downstream turbines. The diameter shifts for axial flow impellers with a D = 0.33 t, PBT C = 0.5 t, and 0.25 t were evaluated by Jaworski et al[20]. The three regions with a clearance / tank diameter influencing the critical speed of the impeller were characterized by Oldshue and Sharma[21]. Myers et al. (1994)[18] reported that Clearance / Tank's effect on the inside diameter is significantly smaller than that of the inside diameter of the impeller / tank, And the effect of these two geometric parameters is not entirely independent, reported that, when the low impeller is located at a clearance of approximately 0.17 T or smaller for two disk turbines, the impeller stream was not radial; it was directed to the base of the vessel. It has reported that the impeller speed and mean energy rate of dissipation for the critical condition of thepaddles has decreased with the clearance decrease in the solid mix of a fluid from 0.33 T to 0.166 T. The findings above show that radial flux impellers of low clearance can guarantee useful applications such as solid suspension at lower energy consumption levels incomparison with standard specifications. The flux pattern changes with clearance of D / T = 0.5 and 0.33were also noted by Kresta and Wood [23] Bettorf and Kresta [24] and registered. The height between the tank base and the impeller was raised from 0.05 T to 0.5 T. The flow discharge angle was shifted from the axial direction into the radial flow direction at high speed as the off-bottom clearance was improved. Three regions were defined with critical speed vs. impeller clearance plot. The clearance ratio and the tank diameter in the first region are only compatible with the suspension speed by raising the impeller clearance. The inverse of the arrangement where the propeller would be at the base of the vessel. This observation relates to the local energy dissipated at the base of the vessel, which is constant while the propeller operates at the base of the tank Baldi et al., 1978[25]. Both turbines with a low-possibility ratio between the leeway of the turbine and the inner width of the tank below 0.1 operate like the point stream of the turbine and create a single eight-circle current. The suspension RPM will easily be raised at the impeller leeway with the tank size over more than 0.1. The phase of the stream ranges from one-eighth to two-eighth for winding stream impellers, and this can alter the solid suspension instrument. A distinction within the stream system defines the creation of only the suspension level. The change in only the speed suspension is related to the change in the flow pattern. At any clearance above 0.35, the flow paths originating from the impeller touch the wall before hitting the base of the vessel. They slip down or down the wall as they hit the surface. It pushes the pressing flux impeller into the spinning flux impeller.

Bourne and Sharma, 1974; Kresta and Wood, 1993; Sharma and Shaikh, [26]-[28] studies on the impact on the clearing of the flow pattern have been conducted. The double loop flow pattern of the flat disk Turbine was observed to undergo a single loop transformation at impeller clearance of approximately 0.2T. Also, statistical fluid mechanics for axial flow impellers investigated the transition to disk turbine of the flow system. The transition from twice eight to twice eighth is registered at clearance equal to 0.15T.

The effect of the impeller clearance on the paddle blade turbine flow pattern of the vessel with the bridge was analyzed by Kresta and Wood (1993)[27]that by increasing impeller clearance, the flow angle from the axial direction into the radial direction is changed. K.J. Myers and A. Hicks M.T.Bakker[29] the 4-bladed rigid suspension with angle 45° of pitched turbines and high-limit impellers was investigated. Sharma et.al.[28] proposed that all throttles with an inner diameter of less than 0.1 Displacement ratio between throttle and tank act as the middle point throttle and create a single eight-circle current. This low-open extension of the entrance is the most suitable position for the propellers. Andrew Tsz-Chung Mak [30] The clearance range of 0.25 T to 0.125 T was checked for the effect of the impeller clearance on the solid suspension. Multiple impeller systems were frequently studied, including two forms (multiple pitched and flat / pitched) and a half or two-diameter spacing of the impeller. Solid concentration varied by weight between 0.1 and 40 per cent

The different parameters were studied; the impeller speed, using an optical tachometer, the power input, investigated the post torque produced by the strain tests, only the suspension speed, detected both clearly and by the sound system technique and the surrounding solid population, assessed by an in-house solid fixation study. In this analysis, by increasing the calculation from 0.3 to 0.6, the degree of parameters for the proportion of the diameter of the impeller and the interior of the tank was covered; the impellers are the most disastrous for the rigid suspension. Tests with three geometrically identical impellers show that the findings are in reference to rates of tip speed or power consumption, which further describe the push force of the impellers.

In the mixing of four separate impellers (A310, marine propeller, front pitched turbine, A320), Ian Torotwa and Changing Ji[31]has been investigated into the effect of the impeller size, heavy amounts, molecular scale, high thicknesses and impeller volume. The ERT (electrical square tomography) experiments were correctly organized with common skills tested. In order to investigate the blending efficiency at the moment, the speed of the impeller required for most noticeable homogeneity, blurry stature and practically suspended speed of the impeller was examined. A consistent choice of Njs is important in the configuration of specifically actuated vessels. It is necessary to be able to accurately determine only particle suspension speeds when designing mechanically agitated vessels. A gold cyanidation process example was used in the study given by Jafari et al.[32]. Any suspend able or overpriced particulate velocity alone will detrimentally impact industrial processes. If even the suspension speed is underestimated the gain from performance would be decreased from 20 to 60%. Thus, when constructing mechanically stirred vessels for the mixture of solid-liquid phases, the procedure for the calculation of the hanging speed alone should be selected with great caution. Characterization approaches come from semi-analytical or analytical studies using experimental methods to determine the only hanging speed for solid sections that are dissolved in the liquid phase. In general, these approaches can beclassified into either visual or non-visual methods.

The system for observing suspension speed only down from Zwietering, as mentioned above, is one of the earliest visual techniques. This method has been applied extensively by severalresearchers Armenante and Kirwan, Armenante et a.,[33],[34].The biggest benefit ofZwietering's method is consistency. This method is unsuccessful however when the suspended particle size is small, since the tiny particles on the bottom of the tank are difficult to locate at higher rpm.In fact, the suspension on the bottom of the tank is less visible at large rates of solids, making it impossible to track particle movement on the bottom of the tank.

In addition, Wu et al. [35] pointed out that single particles or a smaller amount, also at a very high agitator level, will stay stagnant at the corner of a corner and that the state of just a limited number of particles is irrelevant to evaluate the level of the suspended particles.

Other visual strategies for the effective management of this system have been developed. Einenkel and Mersmann[36] suggested a more visual solution focused on the representation of the fluid and the grains at the base of the tank and the contact between the slurry and the transparent fluid. The solid suspension was described as the speed at which the height of the interface from the base of the vessel is 90 percent of the total height of the liquid. In this process, comparatively small particles will always be suspended above the liquid surface while larger particles are suspended from the bottom of the vessel.

As a result, Kraume[37]and Pandit[38] concluded that the rate of particle suspension by this approach should be used in this analysis through studies using the process proposed through Wu et al.[39],[40]. The method suggested to detect particle suddenness in liquid was the basis of the experimental approach. The process of Nikora and Hicks [29], the sedimentation bed height (BH) was measured at various agitation speeds and the suspended velocity particles were defined at which the height of the sedimentation bed is zero and a further reduction in the velocity of the impeller will result in a noticeable bed height exceeding zero. Typically, the bed height, recorded as the average filet height along the tank wall, was determined at a point in the center of two consecutive baffles.

The measurement of the velocity of the suspension particles used in this method was determined to be between -2 and + 2 percent. The above method was used for the study of suspension behavior at high solids concentrations. For non-visual methods to explain the Pandit.et.al [38] suspension speed, different definitions have been used, such as the energy consumption or time mixing discrepancy. The vessel's bottom is moved to a high focus automatically, the stable static layer reflectionsat the base of the hull, Michael et al. friction changes at the vessel body [41].

The latest technique based on gamma ray densitometry was recently reported by Jafari et al. [42].It is important to note that the suspension speed estimation varies greatly and the fundamental value is not associated with it. The solid suspension speed calculated by Bohnet and Niezmak [43] was estimated using nine ratios to determine that the values of their own value were in the range of -56 to + 250 points. Therefore, determining the suspension particle velocity relies on specific techniques and measurements by researchers. In Figure 2 the particles moving at suspension speed in three stages were clearly observed.

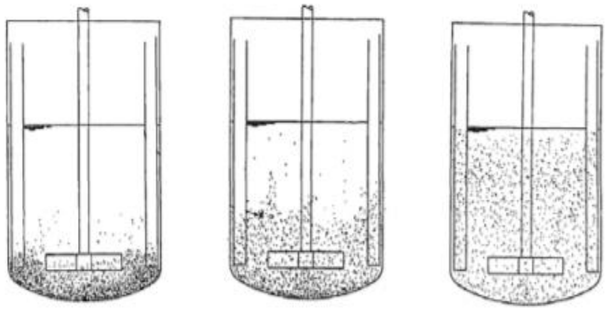


Fig.2.Particles settled in bottom of tank for different speeds [43].

C.Effect of baffles on the suspension volume of particles:

The tangential speed component of the stream is greatlydecreased by interference and therefore the radial separation is diminished. If it is unacceptable that the solids in a mechanical stirrer tank are not dispersed in a radial way, the solids should be mixed in with baffle layer. If the particle density is less than the fluid density (ps < pl), the usage, or equivalent, of weakened vessels without baffles is inappropriate for Braginsky et al.[44].

The marginal turbulence expected for off-bottom suspension in a congested tank is considerably smaller than that needed for an uncongested tank in a jacket-bound vessel tank. A revolving rotation of the impeller at low viscosity liquids imparts a range movement or spinning, often accompanied by the formation of asurface vortex, to a vessel that is distressed. The rotational force needed for a troubled suspension is fantastically smaller than for a tank. This spinning motion approximates the rotation of the rigid body with minimal mixing in the absence of baffles, resulting in a weak distribution of solids. The required agitation strength or only the suspension speed needed for the off-bottom suspension is given by Paul et.al[9] in an unbleached tank the methods are non-visual methods.

$$Nj_s = s.\vartheta^{0.1}.\left(g.\frac{\Delta p}{\rho_L}\right).X^{0.13}.d_p^{0.2}.D^{-0.85} \quad (1)$$

Njs= the minimum impeller speed
s= Shape factor called Zwietering constant
ϑ= liquid kinematic viscosity
g= acceleration due to gravity
Δp= solids-liquids density difference
ρL= Liquid Density
X= is solids concentration by weight ×100
dp = Particle diameter
D=impeller diameter

Wu et al. [40] pointed out that the increased mixing time is generally not an problem because the reaction time scale and the slurry residence period in certain mineral processes can be much longer than the mixing period. Usually, in gold leaching processes, for example, in practice, residence time specifications range from a few hours to several days, which are an order of magnitude longer than the mixing time, units would be in minutes, concluded that, in cases such as slurry holding tanks or reactors where chemical reactions are sluggish, a superior way to increase energy efficiency is to eliminate the baffles for those tanks if the mixing rate is not critical.

D.Type of impeller effect on the suspension of solid particles:

The primary source of energy in an excited vessel is power dissipation by turning the impeller. In pumping and down-pumping, researchers have focused on a variety of typical impellers such as disk turbine, flat blade with angle arm, axial rotor, and pitched rotor turbine.Coefficient exponents of particle diameter are found to be independently of impeller clearing, difference in solid-liquid density, liquid viscosity and f solids concentration, as well as to be increased by the Zwietering constant. In addition, the efficiency of Raghavarao et al.[19] is improved by the rise in blades.

Chapman et al. [15] reported that, with respect to a ratio between impeller diameter and tank diameter, an increase was 0 from four to six blades with a mixed flow impeller, with a power drop of about 13% and suspension velocity of up to 9% and concentrations of soda glass fibers down to 1%. In suspension of solids, blade patterns play a critical role. For 30^o blade angles, radial flow can be considered unimportant. On the other hand the radial flow, described by Musil et al. [44] is indispensable to a blade angle of 45 °. For pitch blades down flow turbines, Raghavarao et al.[19] are based on impacts of blade width and thickness.

The value of the critical roller speed decreased slightly as the blade's thickness increased, while the other outline parameter continued to be consistent with increased strength. The Njs value was 0.35 m diameter for blade width. The selection of a proper drive for the suspension requirements is critical because distinctive drivers produce different fluvial patterns, which affect the energy efficiency of the system. Their hydrodynamicsare distinctive. Small-to-medium solids have been used already and usually pitched blade impellers are stronger than disc Turbines, whereas the down flow of a pitched turbine consumes less energy than the up flow impeller pitched turbine Frijlink and others, Ibrahim and Nienow [45],[22].

In the previous research reports it was concluded. The flow simulation experiments demonstrated the very complex configuration of Kresta and Wood, Bittorf and Kresta, Kresta et al. and Rammohan [23], [24], [46] in the axial and radial flow impeller flow patterns. Variations in flow pattern leadto a good mechanism for suspension. Radial flow pushes transparent particles through the middle of the vessel base and hangs them through the base of the vessel through the annulus.

Axial flow impulses are suspended from the edge of the base of the vessel by contrast. It is not easy to move particles from the center to the bottom. In contrast to radial flow impellers, theaxial flow impeller flow pattern promotes suspension.

The impeller's effect is transformed into dimensions-less parameter in most experimental correlations, i.e.S.

Wu et al.[47] have operated on a high volume of high solids at 0,49 and concluded that radial impellers have a stronger suspension of solids than axial impellers, taking into account energy consumption at high solids charging. This is the other way in which low loading solids are also used. The effect on the homogeneity level of agitated vessels vary from 5-30 Wt% of axial impeller types of different impeller sizes, rpm, out-of-ground impeller raise, diameters of particles 210–1600 mm, and solid concentration.

Hosseini et al.[48] developed CFD modeling to investigate the effects on solid suspension of these parameters and contrasted their findings with the experimental evidence. The homogeneity was shown to be increased by increasing speed of the impeller. When homogeneity is the most serious, any more rise in the speed of the impeller is not beneficial but adverse. The explanation for this is the creation of regions at higher impeller speed with low solid concentrations within the circulation loops. Thus, the role of the operating conditions and design parameters in a solid-liquid mixing system has a fundamental part to play in achieving the most extreme homogeneity. Wu et al.[47] worked on the volume of large solids with a high volume with 0.49 and found that radial impellers are better to suspend solids than axial impellers despite their power requirements at high solids loads. This is the opposite to what is commonly seen in low load solids. The effect on the degree of uniformity of an agitated boat of axial impeller shapes of various sizes, rpm, off-bottom rotational impelling, particle diameters 210 to 1500 mm and solids are between 5 and 30 wtpercentage. Table 2 indicates the different type of impellers.

E. Effect of the impeller diameter and diameter of the vessel:

Most of the mechanically stressed solid-liquid vessels are flat-bottomed. Some experiments have been carried out on other projects, such as the dish bottom vessel Buurman et al. [49]. Researchers from Chudacek, Musil and Vlk [13],[50] studied the influence of the bottom tank form on the suspension of solids.

The structure of the vessel, in particular the shape of the bottom of the vessel, not only affects the position of the dead zones and the areas where the solids can accumulate, but also affects the speed of the just off-bottom suspension needed to suspend all the solids from the bottom of the vessel. The main difference is the location of the solids between the flat bottom vessel and the bottom vessel of the tub. For flat bottom tanks, the solid fillet is normally formed at the corner of the baffles or along the tank wall. Solids tend to settle in the area between the agitator and the bottom of the vessel for the bottom of the vessel. In a flat-bottomed vessel, the suspension speed is usually 10 to 20% higher than in a flat-bottomed vessel. All experiments in this work will be carried out in a flat-bottom vessel as it is the main type of vessel used for industrial processes.

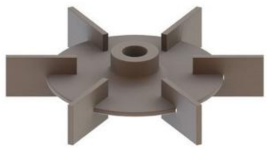
The example of the impelling distance constant vessel diameter in literature differs from Raghavarao et al., [19] to Zwietering,[12]., radial flow impellers. In order to explain the impact of rotor diameter on solid suspension in distinctive rotor designs, Raghavarao et.al.[19] rationally demonstrated their clarity. At a consistent tank diameter with increasing pulsing rate, the critical impeller speed for the off-ground suspension was found to decrease. Nienow[51] talks about how the disk turbine is used most effectively when large ungased suspension turbines are used.In comparison with the smaller impellers, the bigger diameters of the rotor will be 0.5 times tank diameter, ensuring safe operation.

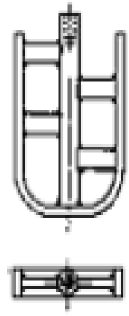
The vast majority of the big suspended speed studies in flat vessels have been conducted below. The minimum speed in a flat-bottomed vessel is typically 10 to 20% greater than in the flat-bottomed vessel. The effect of base roughness on speed suspension was taken into account by Ghionzoli et al.[52]. Base roughness is related to the particle size, and suspension for small particle size has been shown to be accompanied with roughness.

F. Effect of Baffles:

The use of errors to cover up turbidity in the fast mixing ship also enhances the mixing of Nagata et al.,Sterbacek and Tausk, [56],[57]. The increase in vortices will affect the coefficient of mass exchange. In unblocked tanks, the effects on the coefficient of agitator speed were usually smaller than in confounded boats, Levins and Glastonbury [54] showed. In view of the deficient or fragmentary suspension of the particles, unchallenged vessels give higher coefficients, while in the case of completely suspended particles, confounded vessels give higher coefficients to Barker and Treybal, Harriott, [58], [53]. With the use of force input per unit mass intended to relate the information, the distinction between the possible results of jumbled and unchallenged vessels evaporates Harriott, Levins and Glastonbury, Lal et al. [53]-[55]. Harriott[53] also found that when the solids are somewhat suspended at low throttle speeds, Oldshue[59] has shown that presenting befuddles breaks the vortex and advances a flow plan conductive to an extraordinary tumult has investigated the impact of a misaligned slack on fundamental throttle speed in a level base agitated vessel with HE-3 and 4PBT impellers. Four correspondingly partitioned surprises were used with tank widths of 1/12 of the width. The baffles were set away from the vessel divider by a distance from T/12. The in fuddles were designed in such a way that their misguided breathing space could be modified. Their study found that Njs with a HE-3 impeller demonstrated inconsistent reliance on the confounding misguided opportunity at the lower clearances in any case additions at the highest clearances. Furthermore, Dreweret al.[60] studied the impact on just suspension of speed an extraordinarily misled breath space. The marine propeller was best achieved with complete bumps; the 6-sharpe border turbine, on the other hand, had a severely reduced power at a high level of solid obsession with the introduction of a defective confusion area. Unfriendly vessels or vessels with poor ignorance were seen to be more critical than vessels with complete perplexities for the single-stage system.

Table 2: Indicates of Applications of agitator types, application, advantages, disadvantages

S.No	Agitator Type	Applications	Advantages	Disadvantages	Pictorial Representation	Viscosity Ranges
1	**Paddle**	1. Mixing of Solids, 2. Slurry Mixing, 3. Used during Crystals forming phase during Supersaturated Cooling	Strong works, It is mainly used for slow operation,	Power Consumption is very high, Inefficient Mixing		$10^2 – 3 \times 10^1$ (cp $10^{-1} – 3 \times 10^1$(kg/m-sec)
2	**Turbine** Straight blade Pitched blade Curved blade Disk blade	1. For mixing of fluid -gas, 2. There will be high reaction changes	Generates high Radial Flow, Highly used for dispersion operations	High viscosities fluids cannot be used		$10^0 – 3 \times 10^4$ (cp) $10^{-3} – 3 \times 10^1$(kg/m-sec)
3	**Screw type**	1. For special purpose to use other agitators 2. Food industries will be used.	Uniform mixing of High viscous masses. .	Not preferred for non Newtonian solvents		$3x\ 10^3 – 3 \times 10^5$(cp) $3 – 3 \times 10^2$(kg/m-sec)
4	**Helical Blade** Ribbon Type Helical Screw	Used in paint industry	Can handle Visco-elastic liquids efficiently	Not properly mixing		$10^4 –$ $2x10^6$(cp) $10^1 – 2 \times 10^3$(kg/m-sec)
5	Anchor	Pharmacy industries will be using	Increase possible heat transfer rate in reactors, from reactor heat transfer surface to Mass. .	Required high Efficiency ,but high power should be used Power		$10^2 – 2 \times 10^3$ (cp) 10^{-1} – 2(kg/m-sec)

6	Gate	For heavy blending operations	Provides efficient Mixing and agitation control, Can handle Pseudo-plastic liquids.	Not preferred when both liquids and gases combine involves		10^3 – 10^5(cp) 10^0 – 10^2(kg/m-sec)
7	Propeller	Used for corrosive and non corrosive materials.	Mainly for homogeneity, For different patterns in wet and drying. .	Need to be high for settling the granules. Need to be operated at low speed		10^0 – 10^4 (cp) 10^{-3} – 10^1(kg/m-sec)

IV. RESULTS

The following observations have been found based on the analysis of the above literature.

- The efficiency of heat transfer rate depends on Just suspension speed of the particles.
- In order to minimize the turbulence the ratio of the clearance of impeller and tank inside diameter is the main factor.
- The ratio of impeller diameter and tank diameter varies it effects on the efficiency of heat transfer and mass transfer coefficients.
- For use of baffle plates is always depends on the particle size and characteristics.
- Impeller design should be selected based on the experimental setup and the functionality requirements.

V. CONCLUSIONS

This paper is summarized with an overview on definitions, standards, methodologies, associated with Agitation process. This work also critically examined various Geometrical and Agitation Process parameters such as clearance, diameter of impeller, diameter of vessel, liquid depth, baffle width, speed of the impeller and power of agitation to improve the heat and mass transfer for coal gasification. The effect of grain size, particle density also plays a prominent role in deciding various characteristics features of solid-liquid mixing process. It is further identified that the selection of suitable parameters varies according to the operating procedures related to individual applications. It has also been observed that coal water slurry is widely used for the sake of eco-friendly environment in the power plants. This work can be extended further to have robust design of tank, selection of impeller, development of mathematical models, fluid particle interactions using simulation studies, and optimization of process parameters for maximum yield.

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