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PROPERTIES OF SELF COMPACTED RECYCLED AGGREGATE CONCRETE (SCRAC) WITH DIFFERENT TWO STAGE MIXING APPROACHES

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ABSTRACT

This article addresses the methods of improvement of mechanical properties of self compacting concrete (SCC) with the use of coarse recycled concrete aggregate (RCA) obtained from construction and demolition (C&D) waste. Two stage mixing approach$_{(silica\ fume,\ fly\ ash\ and\ cement)}$ *(*$TSMA_{sfc}$*) is employed, in which 6% silica fume and proportional amount of cement is added to the recycled aggregate in the premix stage. All the other quantities of ingredients are added subsequently as per recommended procedure of mix design of SCC in the literature. In* $TSMA_{sfc}$*, addition of silica fume and cement in the premix stage fills up the weak areas in the RCA and thus stronger interfacial transition zone (ITZ) is developed around the aggregate, resulting improved strength in the concrete. Experimental results show that 100% replacement of RCA marginally affects the mechanical properties in two stage mixing approach (TSMA). However,* $TSMA_{sfc}$ *significantly improves all the mechanical properties as compared to normal mixing approach (NMA) and TSMA.*

Keywords: C&D waste, Fly ash, RAC, Self compacting concrete, Silica fume, TSMA.

I. INTRODUCTION

In recent years, the reuse of waste concrete as recycled concrete aggregate (RCA) to replace natural aggregate for new concrete has developed. It is commercially sustainable and technically good for recycling waste concrete. Recycling of concrete waste is beneficial and necessary from the view point of environmental preservation and effective utilization of resources. The construction and demolition (C&D) waste is one of the main and important resources for a sustainable construction. C&D waste causes various environmental problems such as the use of landfill space, illegal deposits, etc. Therefore, recycling of these C&D waste for the production of new aggregates is a solution to a number of problems. RCA is manufactured by crushing and screening the coarse aggregate and the concrete manufactured with these aggregates is normally known as RAC. Many literature paper shows that RAC can be used as self compacting concrete (SCC). SCC fills formwork in the presence of congested reinforcement under its own weight. Flowability, filling ability and segregation resistance affects the mechanical and durability properties of SCC. Flowability is achieved by using admixtures such as fly ash, silica fume, ground granulated blast furnace slag, superplasticizer (SP). This paper presents the fresh and mechanical properties of self compacted recycled aggregate concrete (SCRAC) with two stage mixing

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approach and two stage mixing approach(silica fume and cement) with suitable presence of admixtures like fly ash, silica fume and superplasticizer.

Otsuki *et al.*[1] have done 100% substitution of RCA and followed double mixing method. They observed that, the compressive strength and tensile strength enhanced by 4.18% and 5.25%, respectively, after 28 days of curing. TSMA was first developed by Tam *et al*. [2] in which the mixing process is divided into two parts and the required water is proportionally split into two, which is added at different stages. Here, the improvement of compressive strength was achieved by 21.19% for 20% of replacement of RCA in 28 days curing period. Tam *et al*. [3] proposed another two different mixing methods i.e. $TSMA_{p1}$ and $TSMA_{p2}$. $TSMA_{p1}$ gave 11.47% improvement in compressive strength than NMA for RAC for 25% replacement of RCA. However, $TSMA_{p2}$ observed 19.75% improvement in compressive strength for 20% replacement of RCA. Tam and Tam [4] also developed two other mixing approaches and compared the result with NMA. For TSMAs, after 28 days of curing, the compressive strength, flexural strength, tensile strength, and static modulus of elasticity were enhanced by 19.50% for 25% RCA substitution, 20.04% for 20% RCA substitution, 16.16% for 10% RCA substitution and 16.28% for 30% RCA substitution respectively for $TSMA_s$. However, for $TSMA_{sc}$ after 28 days of curing, the compressive strength, flexural strength tensile strength and static modulus of elasticity were enhanced by 19.73% for 25% RCA substitution, 4.44% for 25% RCA substitution, 24.22% for 5% RCA substitution and 11.92% for 30% RCA substitution, respectively.

II. MATERIALS AND METHODS

2.1 Materials used

Ordinary Portland cement, silica fume and fly ash were used as the cementitious material in SCC mixtures. Ordinary Portland cement of 43 grade with specific gravity 3.15 confirming to IS 8112-1989 [5] was used. Class-F fly ash produced from Bokaro Thermal power plant, Bakaro, India was used. The physical properties of cement, class-F fly ash and silica fume are given in Table 1, Table 2 and Table 3, respectively.

2.2 Aggregates

Locally available river sand and the crushed stone (20 mm maximum size) were used as fine aggregate and VCA, respectively. RCA were obtained from a concrete waste of 35 years old building in Dhanbad, India. The fineness modulus of fine aggregate was 2.45 and confirming to zone II as per IS 383-1970 [6]. The physical and mechanical properties of VCA, RCA and fine aggregates are presented in Table 4.

2.3 Water and Admixture

Potable drinking water available within the Indian School of Mines, Dhanbad, India, campus was used for making all mixes. SP is generally added to increase the flowability of SCC with reduced water content. Modified poly carboxylic ether based admixture GLENIUM B233 was used in present study.

Table 1.Physical Properties of Cement

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Sl.no	Characteristics	IS:8112-1989 specifications	Value obtained
1.	Normal consistency (%)	-	29
2.	Initial setting time(min)	30 (min)	76
3.	Final setting time(min)	600 (max)	216
4.	Fineness(Retained on 90µm)	10 mm	7.00
5.	Specific gravity	-	3.15
6.	Soundness(mm)	10 (max)	2.50
7.	Compressive strength (N/mm²)		
	3 days	23.00	25.00
	7 days	33.00	35.97
	28 days	43.00	45.08

Table 2. Physical Properties of Fly Ash

Sl.no	Test property	Value obtained
1.	Specific gravity	2.15
2.	Fines passing 150 µ sieve (%)	99.2
3.	Fines passing 90 µ sieve (%)	97
4.	Blaine's fineness (cm^2/gm)	3890

Table 3. Physical Properties of Silica Fume.

Sl.no	Test property	Value obtained
1.	Specific gravity	2.2
2.	Specific Surface Area	20000 m^2/kg
3.	Particle size	0.1 *micron*
4.	Bulk loose density	230-300 kg/m^3

Table 4. Properties of Aggregates

SL.no	Test property	VCA	RCA	Fine aggregates
1.	Specific gravity	2.66	2.62	2.62
2.	Water absorption (%)	0.6	4.78	0.85
3.	Bulk density (kg/m^3)	1,520	1,420	1,680
4.	Crushing value (%)	28	33	-
5.	Impact value (%)	23	28	-

2.4 Mix proportions

The mix composition was chosen to satisfy all specifications given by EFNARC [7] for both the fresh and hardened states of SCC. Mix design of SCC using Nan Su method [8] was followed for preparing SCC mix of M30 grade of concrete. The experimental study included one reference mix which contains 100% VCA and designated as SCVAC. Two other mixes were made with RCA to replace natural aggregate by 50% and 100%

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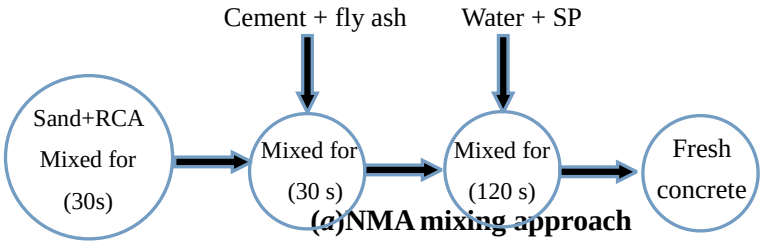
levels and designated as SCRAC50 and SCRAC100, respectively. The results are presented in Table 5.

Table 5. Mix Proportioning for Compressive Strength ($fck = 30MPa$) of Various SCC Mixes by Nan Su Method [12].

% of RA	Mix designation	Cement (kg/m^3)	Fine aggregates (kg/m^3)	Coarse aggregate (kg/m^3)		Fly ash (kg/m^3)	Water (kg/m^3)	SP (kg/m^3)
				NA	RA			
0	SCVAC	315	990	805	-	135	191	4.0
20	SCRAC-20	315	990	644	133	135	191	4.2
40	SCRAC-40	315	990	483	266	135	191	4.2
60	SCRAC-60	315	990	322	399	135	191	4.3
100	SCRAC-100	315	990	-	666	135	194	4.3

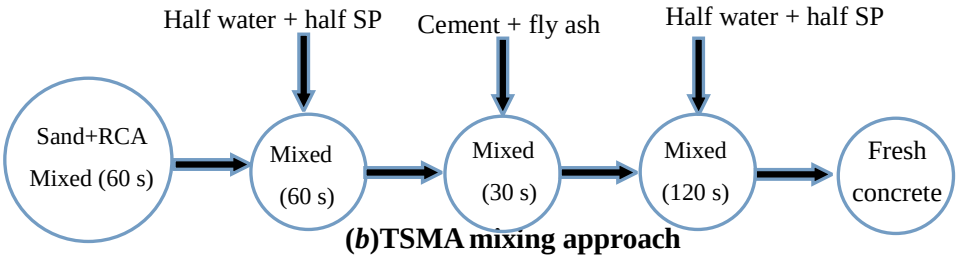
2.5 Mixing approaches

2.5.1 Normal mixing approach (NMA)



(*a*)NMA mixing approach

2.5.2 Two stage mixing approach (TSMA)



(*b*)TSMA mixing approach

2.5.3 Two stage mixing approach (silica fume, fly ash and cement) ($TSMA_{sfc}$)

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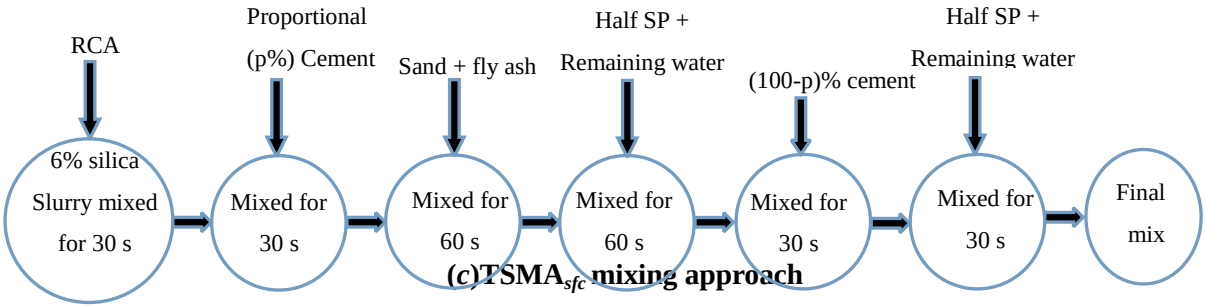

***(c)*TSMA$_{sfc}$ mixing approach**

Fig.1. Flow Diagrams of Different Mixing Approaches Followed in Present Investigation.

III. RESULTS AND DISCUSSION

The test results of slump flow, J-ring and V-funnel test of SCRAC with NMA, TSMA and TSMA$_{sfc}$ are shown in Table 6. T_{50} is the time taken by fresh concrete for reaching a distance of 50 *cm* radially and was measured during the time of slump flow test. The T_{50} value for NMA, TSMA and TSMA$_{sfc}$ with and without recycled aggregate found between 3-5 *sec*. As per EFNARC guidelines [7]**Error! Reference source not found.**, the recommended value for engineering application is between 2-5 *sec* and recommended value for slump flow is 650 *mm*. From Table 6, it is observed that the T_{50} value and slump flow value follows the guideline for all the mixing approaches (NMA, TSMA and TSMA$_{sfc}$). Passing ability of SCRAC was measured by J-ring. It is the difference in height between the concrete inside and that just outside of the J-ring. It is concluded from Table 6, that J-ring varies from 7.5-9.3 *mm* for all cases of mixes with NMA, TSMA and TSMA$_{sfc}$. It is noted that the J-ring value follows the guideline for both the mixing approaches (NMA, TSMA and TSMA$_{sfc}$). Filling ability and flow ability of SCC were measured in terms of V- funnel apparatus, which ranges from 7.8-9.6 *sec*. The fresh properties of SCC with TSMA gives better results in comparison with NMA because in TSMA the pores and cracks present on the surface of RCA are filled up or eliminated during the first stage of mixing. These values satisfy the EFNARC guidelines as the permissible value is from 6-12 *sec*. The fresh properties of SCC with TSMA gave better results in comparison with NMA because in TSMA the pores and cracks present on the surface of RCA were filled up or eliminated during the first stage of mixing. However, for TSMA$_{sfc}$ it is observed that with 6% replacement of fly ash by silica fume, the fresh properties meet the requirement as per EFNARC codal provision. Fresh properties of the concrete mix may be affected because of the presence of excess silica fume due to the larger surface area and very fine particle size, silica fume increases the water requirement of concrete and makes

Table 6. Fresh Properties of Self Compacted Concrete in Different Proportion of RCA Using

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NMA, TSMA, $TSMA_{sfc}$ of Having Compressive Strength ($fck = 30$ MPa)

Mixing methods	% of replacements	Mix designation	Fresh properties of Self compacted concrete			
			T_{50}, (sec)	Slump flow (mm)	J-ring (mm)	V funnel time (s)
NMA	0%	SCVAC	3	750	7.8	7.5
	60%	SCRAC-60	5	700	9.1	8.5
	100%	SCRAC-100	5	700	9.3	10.6
	0%	SCVAC	3	760	7.5	7.3
TSMA	60%	SCRAC-60	4	709	8.8	8.4
	100%	SCRAC-100	5	700	9.2	9.6
$TSMA_{sfc}$	0%	SCVAC	5	700	7.6	8.0
with 6%	60%	SCRAC-60	4	660	9.0	8.9
silica fume	100%	SCRAC-100	4	650	9.6	9.0

concrete mix less workable. For all subsequent experimental investigation of mechanical properties of $TSMA_{sfc}$, the replacement of fly ash by silica fume was taken was 6%. In present investigation, there is an effort for improving the mechanical properties of SCRAC by advanced mixing approach with addition of silica fume. Different mechanical properties are determined with $TSMA_{sfc}$ for 6% replacement of fly ash with silica fume. The maximum percentage of silica fume was kept up to 6% as the fresh properties did not satisfy for addition of more percentage of silica fume. Presence of silica fume in the concrete mix enhances the mechanical properties of concrete because the small size and spherical shape of silica fume fills the voids in the mix. As the voids get fill up, the microstructure of the concrete is improved because of denser pore structure. With the increase of percentage of RCA, the mechanical properties are decreases as RAC possess two ITZs i.e. new ITZ and old ITZ. The old mortar present in RCA forms a weak link in RAC, which contains many pores and cracks. These pores and cracks consume more water causing lesser hydration reaction at the ITZ.

Table 7. Experimental Results on Mechanical Properties of Self Compacted Concrete in

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Different Proportion of RCA Using NMA, TSMA, and TSMA$_{sfc}$.

Mixing methods	% of replacements	Mix designation	Compressive strength (N/mm^2)			Flexural strength (N/mm^2)			Splitting tensile strength (N/mm^2)		
Days cuing			7	14	28	7	14	28	7	14	28
NMA	0	VASCC	23.5	25.9	36.4	3.25	4.23	4.60	2.55	2.78	3.00
	50	SCRAC-50	20.0	22.9	32.6	2.00	3.34	3.43	1.68	1.86	2.05
	100	SCRAC-100	19.5	21.0	30.1	1.87	3.00	3.00	1.42	1.67	2.00
TSMA	0	VASCC	24.1	26.0	38.3	3.67	4.53	4.71	2.70	3.00	3.09
	50	SCRAC-50	21.5	23.8	35.2	2.42	3.48	4.00	2.00	2.18	2.35
	100	SCRAC-100	20.0	22.1	34.0	2.00	3.23	3.48	1.57	2.02	2.30
TSMA$_{sfc}$	0	VASCC	25.9	27.0	39.0	3.78	4.68	4.80	3.00	3.12	3.19
	50	SCRAC-50	22.1	24.9	36.3	2.68	3.81	4.24	2.15	2.63	3.09
	100	SCRAC-100	21.0	23.0	35.4	2.45	3.45	3.90	1.80	2.49	2.70

Hence RAC becomes more porous, less density, and absorbs more water as compared to VCA causing lesser strength and resistance to freezing and thawing [9][10]. Table 7 presents a detail comparison of mechanical properties for NMA, TSMA and TSMA$_{sfc}$ (present mixing approach), for different percentage of RCA replacement. Experimental results show that the TSMA gives better mechanical properties than NMA as a stronger interface zone is developed in case of TSMA. Moreover, in TSMA$_{sfc}$ the cement and silica fume improves the aggregate matrix bond in RAC resulting less porous ITZ and better strength of RAC.

IV. CONCLUSION

Based on the above context, the following conclusions are drawn:

- Large quantities of C&D waste are produced in urban environments, causing serious disposal problems. These C&D waste was found to be suitable for using in place of VCA.
- Nan Su mix proportioning method can be employed for producing SCRAC. This is conducted after number of trials.
- Based on the experimental results from present study, it is observed that the workability of SCRAC decreases with the increase in percentage of RCA.
- The mechanical properties of SCRAC mixes decreased with an increase in recycled aggregate content.
- SCRAC with 6% silica fume (SF) exhibited satisfactory EFNARC guidelines for workability. Moreover, by addition of silica fume all the mechanical properties are significantly improved.
- In this study, two stage mixing approach is proposed to strengthen the old and new ITZ of the SCRCA, providing a stronger ITZ by filling up the cracks and pores within RCA.
- The mechanical properties like compressive strength, flexural strength, split tensile strength and static

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modulus of elasticity are marginally affected by replacement of virgin aggregate by 100% RCA.

- Present two stage mixing approach ($TSMA_{sfc}$) gives better properties of RAC than the TSMA recommended in the open literature. The increase in the strength of mortar and concrete is due to the addition of silica fume and portions of cement. Cement and silica fume improves the aggregate matrix bond in RAC resulting less porous ITZ and better strength of RAC.

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THE INTER-WOVEN FABRIC OF THE CONCEPTS OF ORGANIZATIONAL CULTURE AND EMPLOYEE COMMITMENT – AN ANALYSIS

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ABSTRACT

In the present competitive business environment, organizations are leaving no stones unturned to gain momentum over its competitors. Talent-poaching has become a very "in-thing" and companies do not hesitate in offering a better deal to acquire a talented work-force. Since switching jobs every few years has become a norm in the present day, the organizations need to become innovative in finding ways to retain their talented assets. Committed employees are the biggest assets of any organization as they are always ready to go an extra-mile towards achieving the organizational as well as individual goals. There are various factors which contribute towards generating the feeling of attachment of an employee with its organization.

This paper is an attempt to understand the relationship between the culture prevalent in the organization and the commitment level of the employees. It tries to sift through the theoretical layers of the concepts of organizational culture and employee commitment and establish a relationship between the two. For this purpose, previous researches are studied and a conclusion has been tried to be drawn as to how an organization can use its culture towards building a committed talent pool.

Keywords: Employee Commitment, Human Resources, Organizational Behavior, Organizational Culture.

I. INTRODUCTION

It is a very common phenomenon these days to find the mission statements of the organizations reading something like- "Our employees are our best assets." But, this is not to be treated as a mere style statement and should be taken seriously by the organization. The employees are the driving force of any organization. It is a well-established fact now that a motivated and happier employee is a productive employee.

Every organization has its own set of rules and norms. These are normally the do's and dont's of the concerned workplace. Culture is basically the civilization existing within the organization. Many organizations are big giant multi-nationals and its employees come from every nook and corner of the world. In order to create a harmonious working environment, it becomes necessary that there exists a common boundary within which everyone is expected to behave. This boundary is influenced and defined by the local culture of the society in which it is operating and the values and beliefs of the organization itself. These norms act as a "glue" which

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binds together the whole existence of the organization. Culture exists and operates from within the organization. [1].

In general terms, employee commitment means the attachment of an employee towards his work and organization. It can be defined as the psychological attachment of an employee towards his work and organization. This feeling drives the employee towards working hard for the organization and strengthens his feeling of responsibility toward achieving the organization's mission and goals. It has a great impact on the employee's zeal for his work. [2]. A committed employee always has greater satisfaction towards his work, lower turnover rate and positive organizational behavior. Commitment gives the employee a "push" to work hard and diligently and the employee becomes ready to outperform even his best works. It is a multi-dimensional concept which includes the employee's loyalty, his willingness to exert extra effort, degree of congruency of both organization's and employee's goals and his desire to maintain his relationship with the organization. [3].

The question to be assessed in this article is that whether these two concepts are related or not? An employee's commitment level is affected by various intrinsic and extrinsic factors. Is the prevalent organizational culture one of those factors? Throughout this article, an effort is being made to first understand the conceptual nuances of organizational commitment and organizational culture and on the basis of the review of the previously published researches, a conclusion will be drawn as to whether the organizational culture is having an effect on the commitment of any employee or not and what steps can be taken by the organizations to ensure that the prevalent culture has a positive effect on its employees.

II. UNDERSTANDING THE CONCEPTS

In order to have a better understanding of the subject matter, it is important to understand the underlying principles behind these two concepts. Following is a brief description of the theoretical aspects of both the concepts of employee commitment and organizational culture.

2.1 Employee Commitment

It has been well established by researches that a committed workforce is a force to be reckoned with. It translates into valuable business results for the organization. A committed employee is more engaged with his work and organization, takes pride in his work and has a higher level of job satisfaction. They deliver excellent on-the-job performances.

Two approaches have been taken by theorists in identifying the meaning and factors of employee commitment. The attitudinal theorists advocate like Porter, Steers, Mowday and Boulain define it as the intensity with which an employee identifies with and is attached to the organization. It includes believing and accepting the organization's goals and values, willingness to work hard towards achieving them and the desire to maintain a long-term relationship with the organization. [4]. On the other hand, the behaviorists take into account the cost which an employee relates with his leaving the organization. They believe that commitment is dependent on the accrual of the investments which an employee believes would be lost with him leaving the organization. [5].

The popular theories of employee commitment includes the Exchange theory which believes that there is some kind of psychological contract between the employee and employee specifying "give and take" of expectations

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from both sides.[6]. Another theory known as Role-Conflict theory states that as there are always sub-levels in organizations, there may arise a situation where the employee faces a conflict and ambiguity related to his roles at various levels. The management must ensure that corrective steps are taken towards ensuring that there exists an ambience of role-congruency. [7]. The most popular and influential among all the theories is the Three-Component Model proposed by Meyer and Allen. According to them, commitment has three components namely Affective Commitment which is the positive feelings related to the organization, Continuance Commitment meaning the commitment due to the costs which an employee associates with his leaving the organization and Normative Commitment which is an employee's feeling of obligation to remain with the organization. [8].

2.1.1 Factors Affecting the Commitment Level of an Employee

Various researches have been dedicated towards finding the various factors responsible for making an employee feel committed or otherwise. According to Meyer and Allen (1997), there are several direct and indirect factors involved in the entire process of commitment. For the feeling of attachment to take birth, there are certain peripheral factors which are responsible. Factors like the organizational characteristics (size, structure), demographics of the employee (age, sex, education and income), socialization experiences (cultural, familial, organizational), managerial practices and environmental conditions. All these indirect factors sow the seeds of the feeling and are further affected by certain central factors like work experiences, role status and psychological contracts. The feeling for or against the organization is further strengthened by the fulfilment or lack of fulfilment of expectations from both the sides and cost related variables. The whole process finally leads to consequences like turnover intention or commitment. [9].

In the 80's and 90's, commitment was considered to be mostly a one-sided affair. It was expected from an employee to be committed to the organization as a pay-back of their debt to the company, anticipation of future pay-off, the employee's social identification embedded in the organization and his dearth of available alternatives after leaving the organization. [10]. But, gradually the concept has evolved. Nowadays, it is considered as a two-way affair with a fair amount of "give and take" from both the sides. Organizations are expected to design their policies in such a way that it creates a sense of belonging and security in the employee. In return of such gestures, an employee feels motivated and is willing to put extra efforts to achieve the mission and goals of the organization. Job-satisfaction, competency of the employee, support from supervisors, participation in decision-making, a friendly working environment etc. have been found to be positive influences on the commitment level of employees.

2.2 Organizational Culture

An organizational culture is defined as the values and cultures of any organization which provides it with a unique social and psychological environment. Every organization has its own set of written or unwritten rules and regulations providing it with a distinctive personality. Any new employee is expected to adapt by identifying them and learn them either by themselves or with someone's help. It might be something which is intangible but it influences the behavior of the members. Some experts consider it as the "glue" that keeps the organization together whereas some treat it as the "compass" which helps the organization in navigating towards the right direction.

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It also influences the manner in which the employees and management interact with the outside world and handle the business transactions. These are not necessarily clearly defined or expressly laid down in some manual. They develop as a result of the cumulative qualities of the employees and is reflected in many small and big practices.

One of the most popular theories of culture has been propounded by Geert Hofstede which identifies the major dimensions of culture as Power Distance (degree to which less powerful people in an organization accept and expect power to be distributed unequally), Individualism (degree to which people in a country prefer to act as an individual rather than a member of a group), Uncertainty Avoidance (degree of tolerance for uncertainty and ambiguity), Masculinity (distribution of emotional roles among genders) and Long-term orientation(people in long-term orientation look towards future and value thrifts and savings).[11].

But the above model is more focused towards societal culture as well. So, the commonly used model tp measure organization culture is CVF (Competing Values Framework) developed by Quinn and Rohrbaugh. It takes into account two dimensions- internal/external focus on the one and flexibility & Individuality in contrast to stability and control. It gives us four types of culture- Clan(less focus on structure and control and a greater concern for flexibility), Adhocracy (even greater independence than Clan), Market (seeks control but does so by looking outward) and Hierarchy (traditional approach, strict chain of command) .[12].

2.2.1 Factors Affecting the Culture of an Organization

If we analyze the factors affecting the culture of any organization, there are several internal and external factors responsible. Internal factors are the factors existing within the organization itself like the leadership style, organizational structure and values. The external factors comprise of the social, economic, legal and technological factors.

Some of the common factors affecting any organizational are as follows-

- The individuals working in the organization are also responsible for molding the culture of any organization. Their mentalities, attitudes, perceptions are hugely responsible towards the whole thing.
- Goals and objectives of the organization including the nature of the business.
- The way an organization conducts its business and treats its people.
- Leadership and management style demonstrated in the organization.
- Clients and external parties to some extent,
- The social, economic, legal and technological factors.

Thus, in order to understand the factors affecting the culture of any organization, it is necessary to undertake a detailed study of the various internal and external factors that might leave an impression on the cultural threads. Hence, the management must take into consideration the various paradigms and missions and values of the organization, a constructive approach should be taken to create a better, positive and proactive culture.

III. RELATIONSHIP BETWEEN ORGANIZATIONAL CULTURE AND EMPLOYEE COMMITMENT

The central theme of this paper is to find out the relationship of the culture of any organization with the commitment level of its employees. On the basis of the various researches done in this regard, this paper intends to draw a conclusion regarding the effect any organization's culture has, on its employee's attachment level.

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Agwu (2013), "Organizational Culture and Employee Commitment in Bayelsa State Civil Service" addressed the extent of the relationship between culture and commitment in Civil Services. The result showed that significant relationship exists between the culture prevalent in the organization and the commitment level of its employees. Sex of the employee, age and length of service were found to be determining factors. Hence, team work should be encouraged, employees should be trained and retrained, reward system should be improved, efforts should be made towards improving the communication channels and more employees should be encouraged to participate in decision making. It is important to create a sense of belonging and ownership. [13].

A study conducted in the legal department of Iran tried to assess whether all the components of organizational culture which were propounded by Dennison like adaptability, involvement, adjustment and mission, are related with the level of commitment of the employees of the organization. The paper concluded that a participative organizational culture is much more beneficial towards creating a more committed workforce. [14]. It has also been firmly established that corporate culture plays a very critical role in the attainment of organizational objectives and goals. By cultivating an appropriate corporate culture, job satisfaction, employee commitment and employee retention can also be achieved as an end-game. If the employees are involved in decision-making, they start feeling a sense of belongingness, which automatically leads them toward commitment. Empowerment of employees, team work and employee development programs are found to be having positive influence on commitment. But, flexibility should be maintained as the employees nowadays prefer to be given the freedom to do their work and have their own space. Sometimes, marital status also proves to be a factor. Married employees are more committed towards their work as they need stability. (Nongo and Ikyanyon, 2012) .[15].

According to the research conducted by Sola, Femi and kolapo (2012), in the public tertiary institutions, culture and employee commitment show significant relationship. The commitment levels of employees differ on the basis of age, sex and length of service in the organization. The paper suggested improved management rewards system as one of the measures to ensure higher level of commitment as well as output of the organization. There should be a strong connection between the organizational values and beliefs with those of the beliefs and values of the individual. Only then, the employee would be able to forge a connection with the organization. A well-established recognition program should be initiated for well-performers. Team-work should be encouraged and various team-building exercises should be conducted from time to time. Emphasis needs to be given on communication and Training & Development programs. [16]. Boon and Arumugam (2006) investigated the influence of all the dimensions of organizational culture on employee's organizational commitment. The researchers concluded that open communication in any organization is very necessary in order to create an ambivalent environment. Training and development programs update the skills of the employees and create favorable employee attitudes and loyalty and create a desire to learn and grow. Learning situations are reinforcing in nature. Reward and recognition is also a positive influence towards commitment. Fairness, growth opportunities and being praised for good work also motivates employees and takes them one step closer to the feeling known as commitment. Hence, corporate culture needs to be monitored and evolved. [17].

Organizational culture has been found to having an effect on not only employee commitment but also on the level of satisfaction of an employee from his/her job as well as his intention to leave the organization. Many of the times it is the inefficient organizational culture which forces employees to quit their jobs. A positive organizational culture may also act as a performance-enhancer. Cultural policies should be clear and flexible.

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Decentralized technique of management should be used by the top-management and the low-level employees should be given the feeling that they are valued and given the chance to participate in decision making as well. Team work should be encouraged and the communication channels should be open and direct. [18].

Among all the cultural dimensions, performance orientation and in-group collectivism have the largest effect as antecedents. In client based organizations like the IT Sector where employees move from project to project and client to client, they have to adjust themselves according to the culture predominant in the client's organization. In such cases, the leadership has a challenging task to set their policies in such a way that the transition becomes easy for the employees. This operational change must be supported by suitable measures, so that the employee remains committed and the sub-cultures do not take-over. [19]. In certain industries like the BPO sector, where the turnover rate is very high, it is a very tough job for the management to design their policies in such a way that the aspirations of employees are fulfilled and they are tempted to stay with the organization. In such industries, small sized operations have better chances of retaining their employees than their medium or large sized counterparts. In such sectors, HR plays a very important role in creating competitiveness and growth. Appropriate interventions should be designed relating to any proposed change and implemented in a thorough way, so that not only there is optimum utilization of human resources but also helps in employee retention. [20].

In organizations where the culture is predominantly supportive and innovative, employees tend to be more committed, satisfied and cohesive. Such cultures breed a feeling of belongingness among the employees and they become interested in doing their best towards fulfilling the organizational goals and missions. In large organizations, commitment is more effected by the existent sub-cultures rather than the predominant culture. Whatever policies are designed, they should be formulated after taking into consideration this fact as well. Leadership style with a bend towards consideration of employees has positive effect on the employee's commitment level. . [21] [22] .

IV. CONCLUSION

In a nutshell, it can be said that organizational culture does have a positive effect on the commitment level of the employee. In today's dynamic business world, the employees have also become mobile and they are more open towards changing organizations in search of better opportunities. But, there are some factors which make an employee attached with his work and the organization and he may not be willing to leave the organization. Amongst other factors, culture has been found to be having a profound effect on the commitment process. If the employee feels that the organizational culture is constructive and participative, the management is supportive of the employees he may start feeling a growing attachment towards it. If the management is able to provide the employee with an organizational culture where he is a participant in the decision-making process, the management is considerate towards the needs of the employees, horizontal and vertical communication channels are open, proper reward and recognition system is in place, training and retraining programs are initiated, then it is a very real possibility that the workforce of any organization will start having a feeling of belongingness and attachment with the organization, resulting into a higher level of commitment and retention rate and lower rate of turnover.

Hence, in order to ensure a committed work-pool, the management should consider organizational development interventions in such a way that passive or aggressive defensive behavior should be minimized. Culture change

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programs should be initiated so that constructive factors are encouraged. Programs should be aimed towards encouraging, supporting and reinforcing whatever feeling of attachment the employee has for the organization. Employees should be encouraged to interact with other employees and self-actualizing and affiliative approach should be taken towards work. Employees should be shown approval from the top brass and positive competition should be encouraged. Employees need not be made to stay with the organization but they should be made to want to stay willingly. The employees must feel that they are also needed by the organization and they also have a claim to the ownership, however little the claim may be.

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THE STUDY ON USE OF RICE HUSK ASH

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Abstract - Since olden times materials like mudstone are being used as construction material. A lot of efforts are being made to utilise industrial waste to replace cement. These materials are known as supplementary cementitious material. Also, reduction in consumption of cement reduces the carbon emission produced during cement manufacturing process. Different types of SCMs available are Fly ash, rice husk ash, silica fume and ground granulated blast furnace slag. Rice husk ash (RHA) is a by- product obtained after burning rice husk at very high temperatures in rice plant. It is a light weight pozzolanic material which can replace cement from concrete without affecting the properties of concrete. This paper describes the introduction and production of rice husk ash and its various applications in the construction industry. Henceforth, the properties of rice husk ash are also mentioned. Future recommendations about RHA are also included.

I. INTRODUCTION

The structural stability and strength characteristics of concrete makes it the most widely used material in the construction industry. All the constituents of concrete are obtained from earth's crust thereby depleting the earth's natural reserves. On the other side human activities are producing solid waste in the form of industrial waste and agricultural waste which amount to approximately 2500 MT per year. However, from recent research it has been concluded that these organic and in-organic waste can produce many by-products which can be used in various forms. The commonly available waste are fly ash, rice husk ash, silica fume, ground granulated blast furnace slag and demolished building materials.

The consumption of mineral admixture in cement and concrete has increased considerably due to the recent advances in the construction technology. This increase in demand has been fulfilled by the partial replacement of cement by supplementary cementitious materials. A large amount of cost and energy can be saved by using industrial by-products as SCM for replacing cement. The use of industrial waste in concrete is an eco-friendly method of disposing waste which would otherwise pollute the environment.

Rice husk is one of the by-products of shelling the rice. Husk is the outer cover surrounding the paddy grain. During shelling of paddy 78-80% of the total weight is extracted in the form of rice, broken rice and bran whereas the rest 20-22 % is the husk. The 75% of total husk obtained is an organic volatile material while the rest 25% gets converted into ash during the firing process and is known as rice husk ash(RHA). The firing process continues for approximately 48 hours.

Due to growing demand for high performance concrete, high strength, low permeability concrete and special concrete for the construction of off-shore structures, bridges, nuclear power plant and marine structures etc, the demand for fine amorphous silica has also increased. Therefore, RHA is a good super-pozzolana and serves the purpose. If the concrete structures are not cured properly, voids are formed in it. RHA being finer than cement

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with particle size of 25 microns fill the interstices between cement and aggregates thereby making the concrete more dense and strong.

II. PAST STUDIES

1) The pavers are designed for M30 grade and on 56th day, the compressive strength for 25% RHA is equal to that of the conventional paver block. The compressive strength decreases as the ash content increases. The deflection decreases up to 50% replacement of RHA and increases with higher ash content. Hence 25% replacement of RHA is found to be the optimum level of replacement.[2]

2) Rice husk ash can be effectively used as a sustainable concrete option in severe environments and can be considered as one of the best mineral admixtures due to its unique microstructure.[3]

3) P. Padma Rao, et al[1] stated that there will be a gradual increase in compressive strength from 3 days to 7 days for all level of replacements. The compressive strength of concrete increase significantly from 7 days to 28 days and thereafter a gradual change till 56 days. However, the flexural strength of RHA concrete decreased till 7.5% replacement. Also, with age the flexural strength gradually decreases.

4) Godwin A., et al[4] stated that there is not much change in tensile strength due to the addition of RHA. However, flexural strength showed a marginal improvement at 10 to 25% of replacement levels.

5) As the replacement level of RHA increases the water-cement ratio also increases as RHA is highly porous material. Also, for the same reason the workability of RHA concrete has been found to decrease.[5]

III. PRODUCTION

India is one of largest producer of rice, and the husk obtained during shelling is mainly used as a fuel in boilers or for producing energy through direct combustion. About 20 MT of RHA is produced every year and its disposal causes a huge threat to environment by creating havoc for the land and surrounding area where it is dumped. Many ways are being thought for disposal of rice husk and only a small quantity of rice husk is used in agricultural field as a fertilizer, or as bedding and for stabilisation of soils. Therefore, the use of rice husk as RHA is one of the most viable solution. Rice husk ash is obtained from burning the outer shell of rice paddy that comes out as waste from shelling of rice. Disposal of rice husk is a big problem as it is bulky, each ton of rice paddy produces approximately 220 kg of rice husk which produces about 55kgs RHA after controlled burning. Rice husk is burned at a temperature of around 600-850 ºC which burns it down to grey coloured ash. The ash is grounded in a ball mill for approximately 30 minutes. This RHA contains around 85-90% amorphous silica. Any changes in the burning temperature will vary the chemical composition of RHA due to change in silica content of ash. One of the major hurdle in manufacturing of RHA is that burning of rice husk to very high temperatures for sustained period makes it difficult to cool down to normal temperatures. Also, RHA has an inherited property of retaining heat for long periods. Therefore the method used is to allow the burnt husk to stay for some time and followed by cooling of ash with use of water. However, when this is done the ash is saturated with moisture and therefore grinding becomes a challenging task-especially with an abrasive material like RHA. Therefore drying of rice husk ash is a must and various methods like normal sun drying or dries could be used.

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Fig 1: Rice husk ash

IV. APPLICATION

1) Green concrete - By replacing cement with rice husk ash, there are prospects of producing environment friendly concrete. Ash from rice husks, while not completely neutralizing the pollution that comes from making cement reduces it considerably. Also, this ash provides protection against corrosion and strengthens the concrete.

2) High performance concrete- The RHA concrete is resistant to chloride ion penetration. The RHA concrete also shows excellent performance under freezing and thawing conditions, and its resistance to de-icing salt scaling was similar to that of the concrete.

3) **Insulator**- Rice hulls themselves are a class A thermal insulating material because they are difficult to burn and less likely to allow moisture to propagate mold or fungi.

4) **Roofing shingles**- Clay is one of the cheapest and most durable building material being used. Therefore, to reduce the cost of construction as well as to increase the life of structures the use of clay is being explored. Therefore, RHA is used along with clay to enhance its properties.

5) **Sandcrete**- Sandcrete blocks comprise of binders, water and natural sand. Cement is used as a binder but is the costliest constituent in the production of sandcrete blocks. This has encouraged producers of sandcrete blocks to produce blocks with low OPC content that will be affordable to people and with much profit. The use of rice husk ash as a partial replacement to cement will provide an economic use of the by – product and consequently produce cheaper blocks for low cost buildings.

6) **Paving blocks**- Rice husk ash is being used in paving blocks in many of the countries. Since the specific gravity of RHA is low, it is found to be a light-weight material. As RHA is a carbon neutral green product, there are no hazardous effects on the environment while burning it. Moreover, the green house gas emission from the cement production can be cut down by opting for a replacement material like RHA. Hence the paver block using RHA is found to be economical and trustworthy.

V. PROPERTIES

A comparison between chemical composition of rice husk residual ash and Portland cement has been tabulated below:

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Table No 1: Chemical Composition(% mass) of rice husk ash and Portland cement

Compound	Rice Husk Ash	Portland Cement
SiO_2	82.6	20.1
Al_2O_3	0.4	5.5
Fe_2O_3	0.5	2.7
CaO	0.9	64.4
K_2O	1.8	-
MnO	0.3	-
SO_3	<0.1	3.0
MgO	0.7	1.2
P_2O_3	0.9	-
Loss on ignition	11.9	3.0

VI. CONCLUSION

1. As RHA is a light weight carbon neutral by-product it does not emit any hazardous gases or substances during its combustion or decomposition. Also, as the quantity of cement being used in concrete can be reduced by replacing some proportion with RHA the green house gases emitted during the manufacturing of cement are reduced. Therefore, it reduces the consumption of cement and also sorts the problem of waste disposal.

2. Due to increasing trend of green buildings in India, RHA concrete is being significantly used.

3. As RHA is a porous material with the increase in its proportion in concrete, the water/cement ratio has to be increased.

4. As the proportion of RHA increases in concrete its workability reduces.

5. As RHA contains large amount of silica, hence till 9% replacement of cement with RHA for different mix proportions, compressive strength of concrete will increase.

6. Addition of RHA to concrete does not affect the tensile strength. However the flexural strength of concrete improves marginal with 10 to 25% RHA replacement levels.

7. The thermal conductivity of concrete decreases as the quantity of RHA is increased.

8. FUTURE RECOMMENDATION

1. From past studies and results it is recommended that proper design mixes with different percentage of rice husk ash with cement should be prepared to achieve the adequate strength of the concrete and to reduce the consumption of cement.

2. By using rice husk ash the burden of industrial wastes can be reduced to a suitable extent.

3. A suitable code of practice for supplementary cement materials should be prepared in which strength parameters about rice husk ash are described.

4. Due to its microstructure considerable study needs to be done on applications of RHA in repairing mortars, coatings and soil stabilization

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5. Due to emerging trend in green building the technical and economical benefits of using RHA in concrete should be explored.

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MODELING A COLLABORATIVE MULTI-AGENT SYSTEM USING A PROCESS FOR COMPLEX ENGINEERING SYSTEMS

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ABSTRACT

In this paper, we propose a methodological approach based on ASPECS (Agent-Oriented Software Engineering Process for Complex Systems) dedicated to the analysis, the design and deployment of complex systems. This analysis will allow us to highlight the objectives of our Knowledge Management System (KMS) and the main mechanisms of its functioning. Among the activities ASPECS, identifying needs is through an approach that will allow our but[1] modeling objectives of collaborative system and users of the system and parts of the Multi-Agent System (MAS) support different goals. The idea behind this methodology is based on a needs analysis, to define the main elements of the problem and the organizational structure of MAS that will meet the needs.

Keywords: ASPECS, Multi-Agent System, Knowledge Management System, Modelling, Collaborative

I. INTRODUCTION

CMS can be described as distributed systems where different actors (business actors), act autonomously to achieve a specific goal and interact to achieve a common goal.We propose a model of knowledge management system (KMS) which is based on the methodology ASPECS[2] dedicated to the analysis, design and deployment of complex systems. This analysis helps to identify the objectives of a MAS and the main mechanisms of its functioning. Among the ASPECS activities, identifying needs is through an approach that will allow[3] goals modeling KMS objectives and the actors involved and their dependencies to achieve each goal contributing to the creation of knowledge.

Knowledge management is a very broad field, raising several issues for which have been proposed various methods and techniques. Many studies (Ruggles, 1998)[4] and (Prax, 2003)[5] define knowledge management as a lifecycle consisting of process / phases that highlight the issues of management knowledge in a temporal perspective, such as the life cycle of Figure 1. This cycle of life, proposed in figure1 is intended generic and is organized into four processes.

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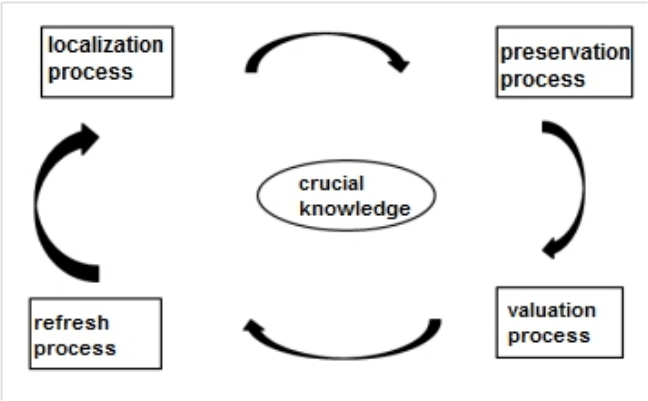

Figure 1: lifecycle knowledge

On this basis, ASPECS proposes to use MAS to facilitate the development of complex software systems. For this ASPECS introduced a particular type of agents, holons, which have the particularity to be composed of (sub) holons interact. ASPECS the development cycle is based on an iterative process. ASPECS provides a comprehensive guide, from needs analysis to implementation and deployment, allowing modeling of a system different levels of detail, proceeding by successive refinements. The approach offers the possibility for the designer to model a system with entities of different granularities. He can recursively decompose a system into subsystems, until reaching a level where the complexity of the tasks identified is MAS enough to be carried by entities considered atomic and easy to implement.

II. ASPECS, A MULTI-AGENT ENGINEERING PROCESS

2.1 Description

ASPECTS is a software engineering process that describes step by step the steps for software development, from requirements analysis through production code and deploy it on a specific platform . It is based on the metamodel CRIO [6], which defines the main concepts for the analysis, design and implementation of MAS.

The phases of the process are illustrated by the figure above :

- The needs analysis aims to provide a description of the organizational system (hierarchical decomposition of the system). It must also collect the available knowledge about the problem domain and organize within an ontology.
- The design of an agent company seeks to build the model of MAS, whose overall behavior should be able to provide a solution to the problem described in the previous phase. Knowledge of the system are refined and incorporate elements specific to the proposed solution.
- The implementation of the solution describes the architecture of the agents involved in the solution and must provide the source code of the application.
- The deployment of the solution is the final phase in charge of deploying the application on the platform chosen.

The modeling language UML is adopted. To fully satisfy the objectives and specific needs-oriented agent approach, semantics and UML notations were extended, and new UML profiles have been introduced including.

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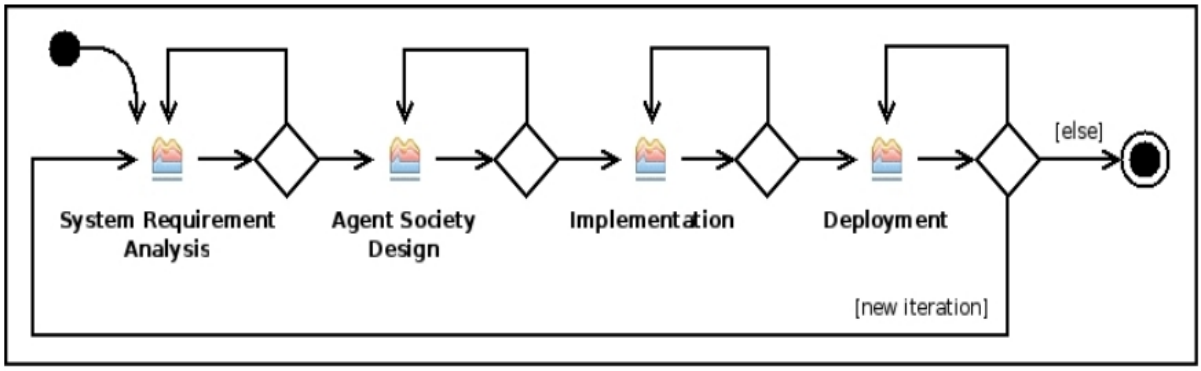

Fig 2: Phases du processus ASPECS[1]

2.2 ASPECS Activities

Each phase of ASPECS consists of activities that keep coming in the order shown schematically in Figure 1.3. An activity is "all the basic tasks performed by an individual or group that lead to the realization of goods or services» [7].

In this figure, the implementation and deployment phases were combined for clarity. Each activity is represented by a rectangle that contains the one hand the name of the activity at the top and the other, the objective of the activity in the lower part.

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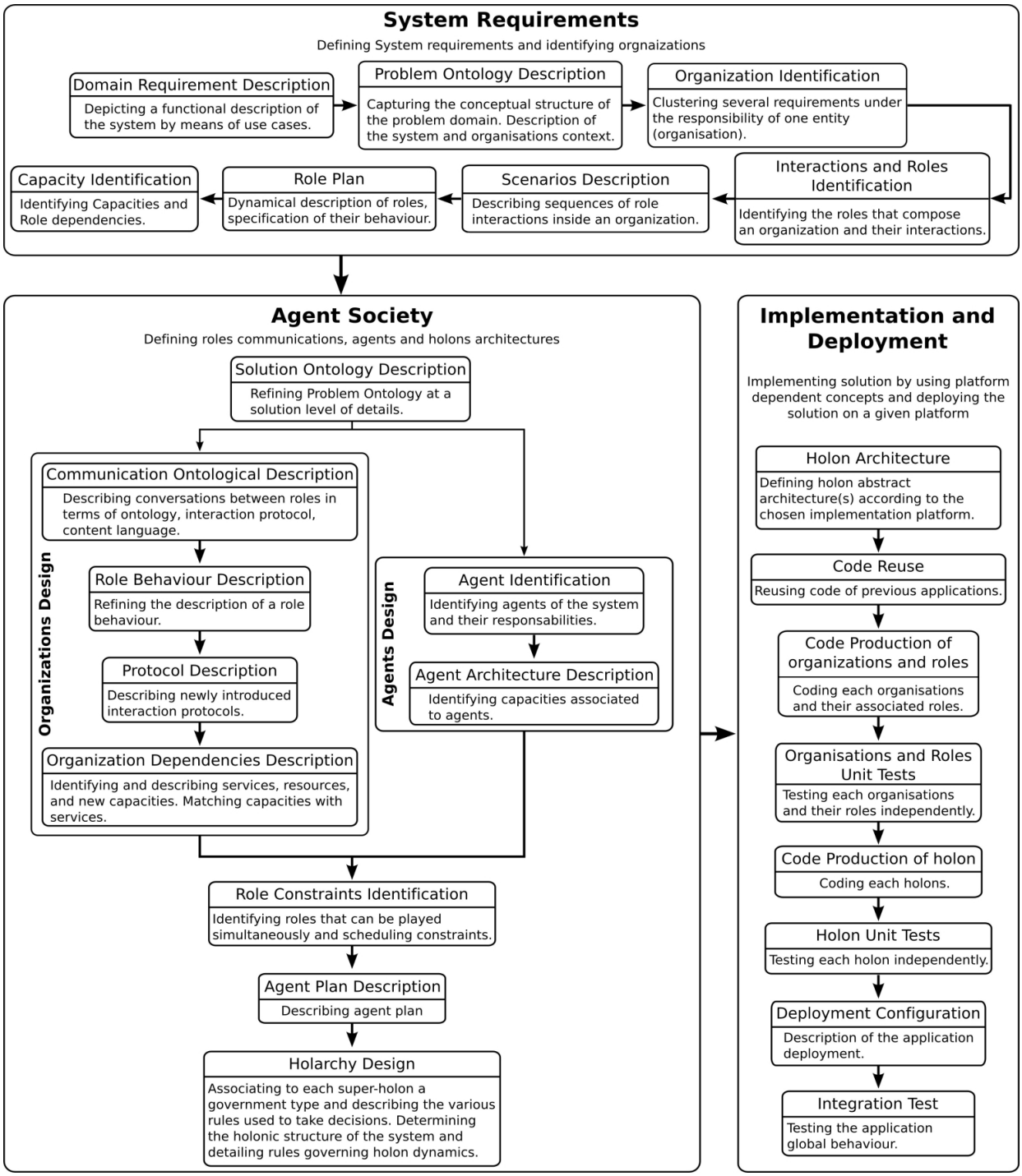

Fig 3: Details of activities ASPECS

III. SYSTEM ANALYSIS

3.1 Introduction

S@J-wiki[8] is a wiki system prototype under development as part of our research. S@ J-wiki serves several purposes:

1. can be used to annotate existing data with terms to improve search and navigation;
2. it can be used to create instance data based on an existing ontology;
3. can be used as a tool for creating and editing ontologies.

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All three goals can be monitored simultaneously, perhaps by users with different roles and different levels of experience in knowledge engineering. Indeed, many engineering knowledge more complex tasks probably require this kind of collaboration.

In addition, S@J-Wiki refers to the following objectives:

- The syntax compatibility and appearance with existing systems (currently Wikipedia); allowing users to take existing knowledge (eg Wikipedia), import in S@J-Wiki, and begin the formalization of knowledge right away.
- Compatibility with existing Semantic Web technologies; Currently, S@ J-Wiki uses RDF and OWL to store and reason with formal knowledge.
- Immediate exploitation of formal knowledge for navigation and existing publishing; Users should get an instant reward for the extra effort they put into formalizing their knowledge.
- Easy access to common tasks; but still give users the functionality and complexity if they wish.
- feeling of an application, not a website; User interface should support the user beyond "wiki syntax" by providing a modern graphical interaction with the system (eg, WYSIWYG editing).

3.2 Identification of needs

S @ J-WIKI is a knowledge management system that has the main purpose of managing multi-source knowledge during the product design process.

The analysis of the main work on knowledge management highlights four principauxis process (Figure 1) :

- definition of knowledge.
- extraction of knowledge.
- validation of knowledge.
- reuse of knowledge.

We can equate these processes to global goals, such as soft-goal while KMS must reach (at least partly). Indeed, it seems difficult to define precise criteria for determining whether these aims are achieved or not.

These four soft goals therefore contribute positively to achieving the soft goal of knowledge management system "knowledge management". In addition, they are linked by the AND decomposition (Figure 8) because it is through the combination KMS may tend to the overall goal.

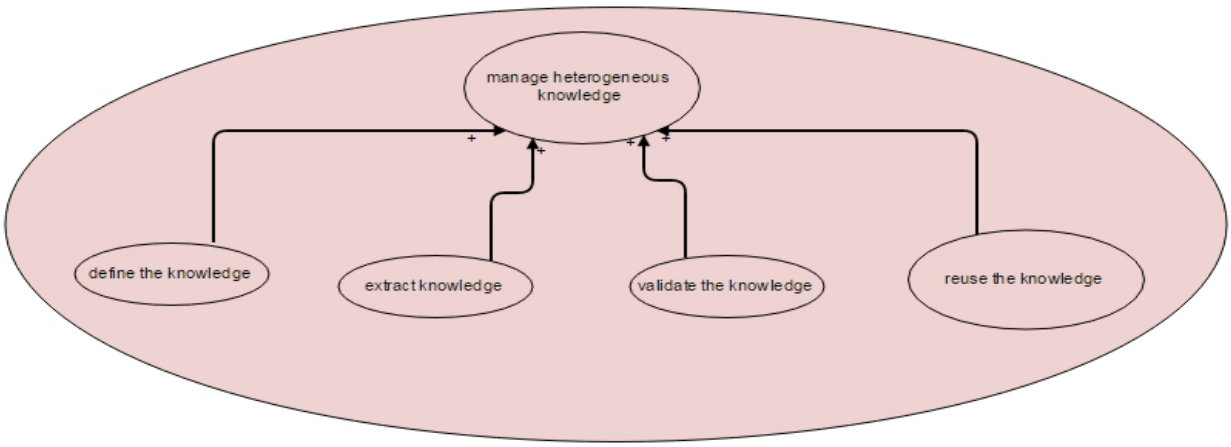

Figure 4 : Global Architecture of the KMS

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3.3 Ontology Problem Description

The overall objective of the description of the ontology of the problem is to provide a conceptual overview of the problem under study. This activity deepens the understanding of the problem with a description of the concepts that make the problem domain.

The ontology of the problem is modeled using a class diagram where the concepts, attributes and actions are identified by specific stereotypes [9].

These stereotypes are:

- "concept" : to designate an entity of the domain,
- "action" : to describe a transformation of a concept,
- "predicate" : to designate a predicate on a set of concepts.

The UML diagram in Figure 9 shows our proposed ontology on the area of interest, namely our S @ J-Wiki system.

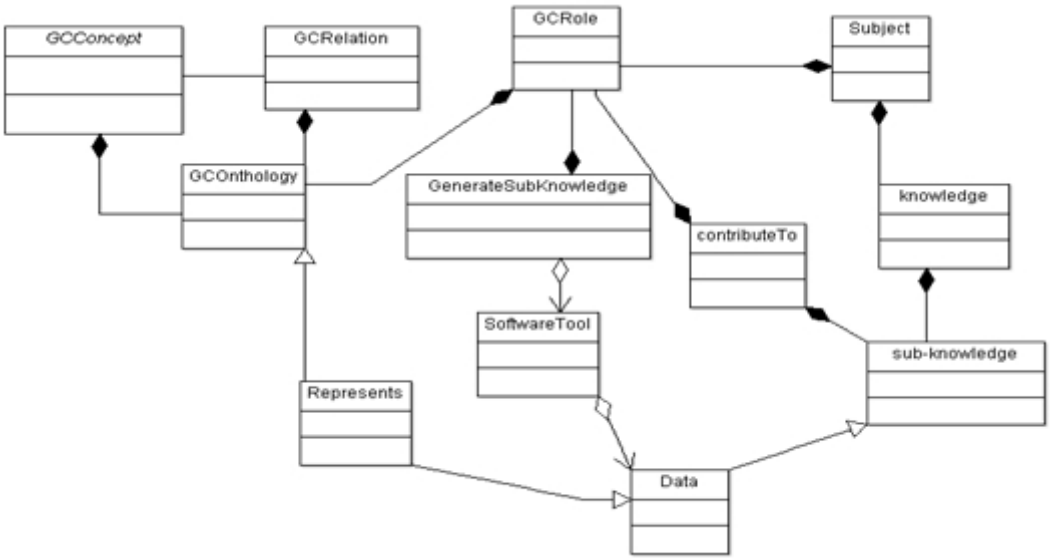

Figure 5: The UML Diagram

3.4 Identification of Organizations

In the activity of identification of organizations, each object is assigned to an organization that will aim, through interaction roles that will compose the organization to meet this goal. The goals identified, Figure 8, are allocated to organizations according to the relationships described in Figure 10. A global organization called J-S @ WIKI represents the interactions for the entire MAS. This organization is divided into four sub-organizations :

- **Definition**, aims to meet the objective of defining the knowledge that will be extracted for reuse.
- **Extraction**, aims, based on ontologies defined by the organization to provide knowledge Definition taken from existing projects to designers.
- **Validation**, aims to meet the goal Validate knowledge.
- **Reuse** allows reuse of this knowledge organizational memory

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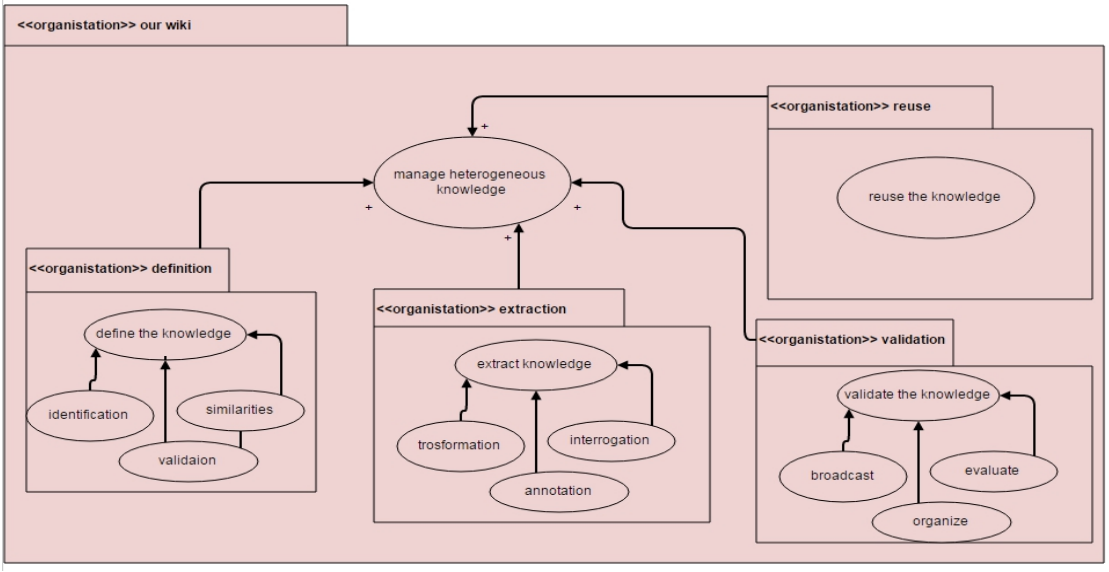

Figure 6: Global Organization of Our System

3.5 Identifying Roles and Interactions

The context and objectives of each organization are now known. Identifying the interactions and roles is to decompose the overall behavior embodied by an organization into a set of roles in interaction.

According Dieng [10]: « A role is an abstraction of a behavior in a specific context and confers status in the organization. The role the entity that gives the right to exercise these capabilities interpreter ». A role interacts with other roles in the organization to accomplish their tasks. This activity must describe the responsibilities of each role in meeting the needs associated with their organizations. Each role is associated with a set of concepts in the ontology.

In this article we'll just present the roles and interaction of the organization **definition**.

Expert adds the role of concepts and relationships GCOntologie ontology. Each new addition or modification, the role ChercheurSimilitude triggers a search mechanism concepts or similar relationships by synonyms, and offers the results to the expert for validation.

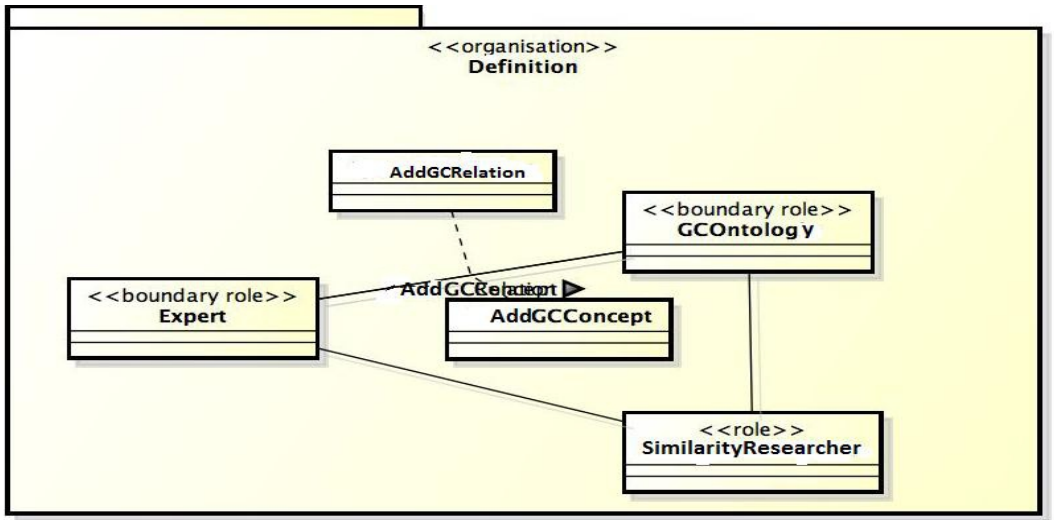

Figure 7: Sub-organization "definition"

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IV. CONCLUSION

This chapter introduces the ASPECS software development process. ASPECS covers the entire development process, from requirements analysis to deployment.

This section briefly summarizes the contributions related to the methodology that will be used later in this manuscript.

Reuse the models and use of organizational design patterns are key points ASPECS. The definition of the behavior of roles on the basis of capacity, increases generics organizations and thus promote their re-use in future applications. In addition, the organizational approach adopted is particularly advantageous for the development of complex applications and promotes modularity, scalability and reuse patterns.

Reuse is also encouraged by the ontology, considered the basic common and transversal knowledge modeling process. Indeed, knowledge of the problem domain are grouped and classified in this database.

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STUDY AND ANALYSIS OF OXYGEN ENRICHMENT ON SINGLE CYLINDER FOUR STROKE DIESEL ENGINE

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Abstract - Pollution is one major factor which affects the environment nowadays, resulting in greenhouse effect and global warming. Suitable methods are introduced to increase the engine fuel economy and bring down the emissions within the tolerable limit. One way of doing it is by inducting oxygen into the combustion chamber since oxygen is a combustion enhancer. The amount of oxygen entering into the combustion chamber if increased would result in better engine performance and lower emissions. Oxygen can be inducted in the intake stroke by the help of an external source and mixing chamber is provided so that it helps in better mixing of air and supplementary oxygen. This additional increase of air will affect all parameters of the engine like operating temperature, fuel consumption, Brake power efficiency, and heat release.

Tests were conducted on a compression Ignition engine for various concentrations of oxygen from (21% to 26.5%). This experimental study shows better fuel economy and better brake specific fuel consumption but led to a very high percentage of Oxides of Nitrogen.

The Oxygen enters the engine's combustion chamber, and mixes with the fuel. The introduction of Oxygen into the combustion chamber creates a more efficient, complete combustion; thereby increasing fuel efficiency while at the same time reduces emissions and increasing power and performance.

The method of providing oxygen which we have used in our study is actually not suitable for implementing in actual automobile application. But this problem can be solved in the future by designing a suitable oxygen separation membrane with respect to the engine requirements.

KEYWORDS:

Combustion, Internal Combustion Engine (ICE), Oxygen enrichment, NOx performance.

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I. INTRODUCTION:

Because of the ever increasing cost of conventional fossil fuels, researches worldwide are working overtime to cost effectively improve internal combustion engine (ICE) fuel economy and emission characteristics. In recent years, many researchers have focused on the study of alternative fuels which benefit enhancing the engine economic and emissions characteristics.

A Diesel engine is an internal combustion engine which uses the heat of compression to initiate ignition in the combustion chamber. Diesel engine has the highest thermal efficiency of all standard internal combustion engine because of the nature of the fuel used pollutants such as soot particles, carbon monoxide, oxides of nitrogen has become a major environmental issue. Diesel engine is always operated in excess air conditions hence air entering has about 78% Nitrogen. Improving engine performance and reducing pollution has always been a problem because higher operating temperature would result in better engine performance but will lead to NOx emission.

To improve the performance and fuel economy of the engine nitrogen getting into the engine has to be eliminated. To overcome the said problem 100% oxygen in the intake can be given which would result in zero NOx emission. But this method has a lot of limitation. Secondly the nitrogen entering into the engine can be replaced by different kind of gas (e.g.: Inert gas) in the intake system so that it doesn't interact with the combustion process and should not be a pollutant to the performing system or to the environment. These both methods have serious limitations. Another way of doing this is by increasing the percentage of oxygen in the intake air which will effectively replace the nitrogen from getting into the engine. This will serve as a suitable alternative. In this study the effect of various percentage of oxygen in the intake air is studied with respect to fuel consumption and emission parameters.

When oxygen is added to the combustion air, emissions of visible smoke, particulates, and unburned hydrocarbons decrease significantly over a wide-load range as a result of the more complete combustion. Added oxygen also leads to shorter ignition delays and offers the potential for burning lower grade and nonpetroleum fuels. However, the increased oxygen content in the combustion air is also expected to increase NOx emission levels because of the higher combustion temperatures. The anticipated increase in NOx emissions could be controlled by retarding fuel injection timing and by using other state-of-the-art concepts such as exhaust post-treatment with monatomic nitrogen and lean-NOx catalysts. The objective of the work is optimizing the level of oxygen enrichment in intake air and also reduction of emission of harmful gases.

II. ENGINE SPECIFICATION:

Make	Kirlosker
BHP	5HP
Speed	1500-2000
No. of cylinders	One
Compression ratio	17:5:1
Bore	87.5mm

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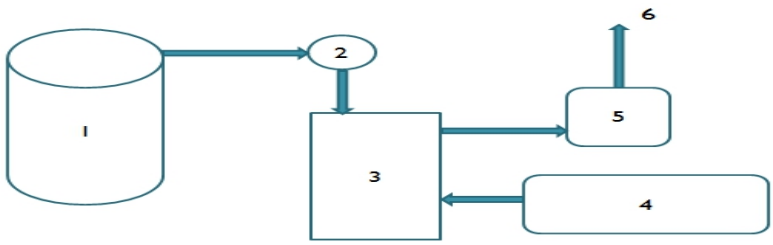
Stroke	110mm
Type of Ignition	Compression Ignition
Method of loading	Hydraulic dynamometer
Method of starting	Crank start
Method of cooling	Water
Engine power	3.75 KW @1500 RPM
Displacement	660cc
Stroke type	Four
Speed type	Constant

III. EXPERIMENTAL SETUP:



(1) Oxygen Cylinder (2) Flow Meter (3) Engine (4) Loading Device (5) Calorimeter (6) To Atmosphere

The oxygen cylinder is connected to the flow control assembly which consists of a pressure gauge and a flow controlling device. The oxygen is supplied to the engine via an 8mm gas pipe whose one end is attached to the flow control assembly and the other end is attached to the V-shaped barrel nipple connected to the air intake pipe of the engine. A hydraulic dynamometer is used for applying load on the engine. The exhaust gases are passed through the calorimeter where the heat carried away by the exhaust gases are measured. The exhaust gases are finally left into the atmosphere.

IV. ANALYSIS:

Before Oxygen Enrichment:-

Oxygen %	**Fuel Consumption (Kg/s)**	**Brake Thermal Efficiency (%)**	**Heat Energy Available By fuel burnt (KJ/hr)**	**Unaccounted Heat Energy Loss (KJ/hr)**
21%	**1.1973×10^{-4}**	**9.24**	**18946.69**	**3964.7**
21%	**1.1942×10^{-4}**	**9.26**	**18897.64**	**3864.62**
21%	**1.1879×10^{-4}**	**9.31**	**18797.94**	**3941.92**

After Oxygen Enrichment:-

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Oxygen %	Fuel Consumption (Kg/s)	Brake Thermal Efficiency (%)	Heat Energy Available By fuel burnt (KJ/hr)	Unaccounted Heat Energy Loss (KJ/hr)
23%	1.03×10^{-4}	10.73	16299.25	2868.50
25%	9.24×10^{-5}	11.96	14621.85	1297.31
26.5%	8.39×10^{-5}	13.19	13276.77	1036.50

V. DISCUSSION:

At atmospheric air inlet condition, the oxygen content going into the engine is 21%. Firstly, we have taken a lot of readings from which few specific readings are given in the table above. From these readings, we can clearly see that the brake power efficiency at normal air is 9-10%. Also, the fuel consumption rate and unaccounted heat losses are high.

As we enriched the intake air with oxygen at different concentrations the fuel consumption went on decreasing as the oxygen concentration was increased. We found that for 23%, fuel consumption rate automatically decreases and unaccounted heat losses also decrease. These values follow the same declining pattern as we continue to increase the oxygen percentage, except brake power efficiency. The values of brake power efficiency have been observed to be increasing with respect to increasing oxygen content in engine.

VI. CONCLUSION:

1. Fuel consumption rate decreases for higher oxygen percentage in the intake air.
2. The amount of black unburnt hydrocarbons coming out of the exhaust drops a very high percentage with respect to oxygen induction in the intake as oxygen helps in better combustion.
3. The brake thermal efficiency which was initially 10% which increased to 14%.
4. The cooling water outlet temperature got increased in direct proportion with the increase in oxygen percentage.
5. The combustion chamber exploded when the percentage of oxygen in the intake air was increased over 27%.
6. The exhaust oxygen percentage gets increased as oxygen enrichment is carried out and NO_x emission increases. But this can be controlled with the help of catalytic converter.

VII. FUTURE SCOPE:

As price of fuels(diesel) is increasing and resources of diesel are limited, it is required to get maximum efficiency of engine with optimum diesel percentage. Along With this there is large pollution created by these engines which is harmful for the environment.

Therefore it is our objective to optimize the fuel consumption, increase the efficiency of engine and also decrease the pollution due to the flue gases. Because of our project of oxygen enrichment in single cylinder diesel engine we can achieve this objective, but there are some limitations to this work. Also there is scope for future study to provide the excess oxygen in controlled manner.

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After such study we can use oxygen enriched engine based all the equipment and do the better use of available fuel (Diesel) along with reduced air pollution.

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