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Preface

We would like to present, with great pleasure, the inaugural volume-5, Issue-2, February 2019, of a scholarly journal, *International Journal of Engineering Research & Science*. This journal is part of the AD Publications series *in the field of Engineering, Mathematics, Physics, Chemistry and science Research Development*, and is devoted to the gamut of Engineering and Science issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

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Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within that community who supported the idea of creating a new Research with IJOER. We are certain that this issue will be followed by many others, reporting new developments in the Engineering and Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IJOER* readers and will stimulate further research into the vibrant area of Engineering and Science Research.

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Comparison of Two Technologies in Hot Water Preparation in Terms of Source Location

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Abstract - *The present article describes two different types of technology used in hot water preparation, their advantages and disadvantages, spatial requirements and measuring technology. The facts described herein may be used when deciding on which technology should be used for which type of hot water supply and central heating.*

Keywords - centralised heat supply, water heating, optimisation of take-off point connection.

I. INTRODUCTION

Efforts of heat and hot water (HW) producers and distributors are focused on providing those media for customers in the highest possible quality and with minimum energy losses during the transportation. That is why producers modernise their technological equipment for the preparation of such media. The scope of reconstruction, however, largely depends on factors specific for individual areas of the Centralised Heat Supply System (CHSS). Equipment modernisation is aimed at optimising the take-off point connection, with regard to new conditions applicable to the offtake of the above mentioned media, with the aim to full satisfy the customer requirements. Technologies used for hot water heating include the so-called *storage heating* and *rapid heating.* Other technologies represent only the combinations of the two.

II. STORAGE HEATING

Storage heating is used mainly in older types of water heating technologies. In this type of heating, certain amount of water is heated in a storage tank by a radiator through which the primary medium flows. Once the water in the storage tank is heated to the required temperature, the primary medium supply pipe is closed until the temperature of the heated water decreases again below the set value. Storage tanks are connected into batteries so that at the peak offtake a sufficient amount of hot water of the required temperature is available. Heating start and end times depend mostly on the amount of heated water collected from the given storage tank and on the temperature to which the circulating water, returned for reheating, was cooled. To describe a working cycle of a storage water heater, a 24-hour experiment was carried out during which the changes in temperatures were monitored for this type of water heating, i.e. the primary medium temperature at the entry into the heater (t_{entry}) and at the output from the heater (t_{output}), the cold water temperature ($t_{c,w}$), and the circulating water temperature ($t_{cir,w}$). Records from the measurements are presented in Fig. 1. The figure shows that the difference in temperatures of the heating medium is at the time of heating approximately constant and changes in these temperatures in time are slow. Such state is appropriate for the measuring technology used at present. Table 1 contains the data on measuring devices currently used for water temperature measuring. For more accurate measurements it is recommended to use the CALMEX VKP meter.

TABLE 1
TYPES OF MEASURING DEVICES USED FOR THE MEASUREMENT OF ENERGY CONSUMPTION FOR HW PREPARATION

Measuring device name	Minimum measured temperature difference	Measuring device name	Minimum measured temperature difference
CALMET 20-KMH 20	3°C	SONO 1000	3°C
SUPER CALL 2	3°C	CALMEX VKP	2°C
SONO 2000	3°C	SCHLUMBERGER CF50	3°C

At present, the main factor affecting the choice of the given technology is the space necessary for the installation thereof. In the storage heating, the storage tank volume is determined while using the formula:

$$V_z = (40 \div 54) \cdot i^{0.75} \cdot z \cdot \psi \cdot \varphi \cdot \vartheta \qquad (m^3) \tag{1}$$

V_z is the volume of storage tanks (m^3), i - number of persons (1), z - heating time (h), ψ - structure impact coefficient (1), φ - hot water preparation method coefficient (1), ϑ - operating impact coefficient (1).

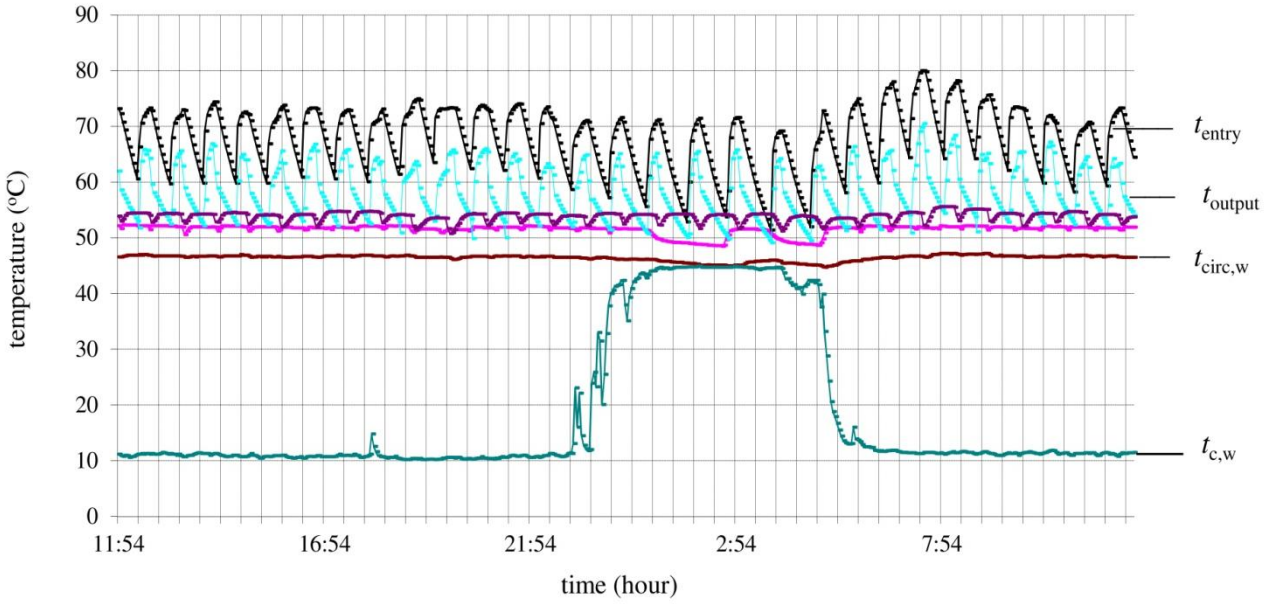

FIGURE 1: Working cycle of a storage water heater

Technology for the storage heating for example for 480 persons requires, with the water heating time of 2 hours, the storage tank volume of approximately 12 m^3. An approximate layout area necessary for placing a heater (best two heaters) with the volume of 6 m^3 is as much as 10 m^2. Particularly these facts regarding the storage heating technology make it less beneficial than the rapid heating technology. The main advantage of storage water heating is the reserve of hot water even in the case of short-term outage of the primary medium, or covering the circulation losses in time at the minimum offtake. Water temperature at the outlet from the storage tank has a liner decreasing nature.

III. RAPID HEATING

In the so-called rapid heating technology, water is heated at one or two levels. Primary water as well as heated water flow concurrently through the exchanger in very small volumes. This method of water heating ensures immediate water heating. To describe a working cycle of rapid water heating, the measurements of changes in temperature were carried out with the same duration (24 hours). The measurements were focused on the temperature of water as the primary medium at the entry into the heat exchange (t_{entry}) and at the output from the heat exchanger (t_{output}), the temperature of heated water ($t_{t,w}$), and the temperature of circulating water ($t_{cir,w}$). The records from these measurements are presented in Fig. 2. As the figure indicates, the temperature of primary medium is not constant and changes in temperature in time are very fast; this has a negative impact on the consumed energy measurements. Spatial requirements for this type of technologies are significantly less demanding than for storage heating, which makes them much more appropriate for the use than storage heating. Another advantage of rapid heating is practically immediate heating of the medium to the required temperature and consequent possibility of using different hot water supply modes. A disadvantage of this water heating method is the need to ensure sufficient heat output at peak hours, which makes the technology overdimensioned during the minimum offtake and produce thus great losses. This technology appears to be equally disadvantageous also in short-term primary water shortage in the network when the heated water is immediately subcooled.

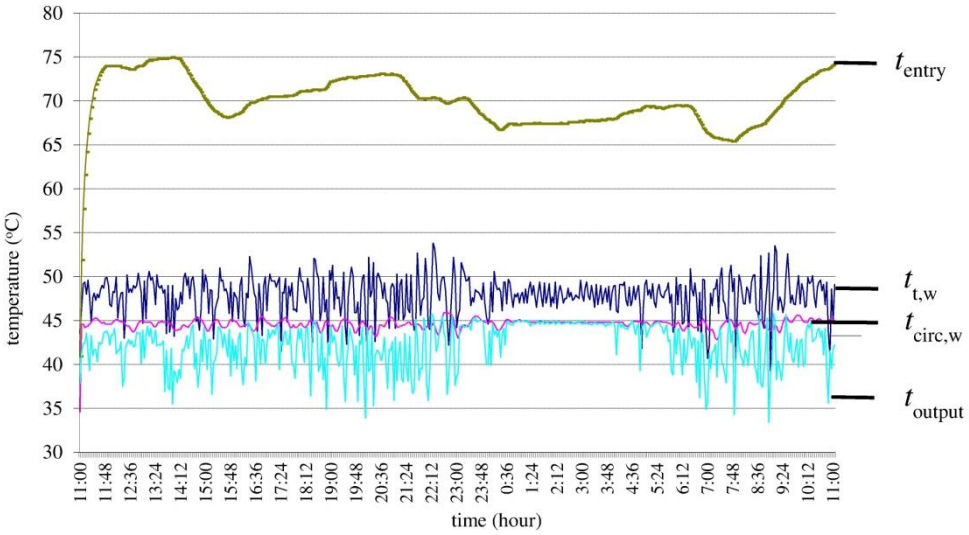

FIGURE 2: Working cycle in rapid water heating

A combination of both technologies facilitates elimination of their disadvantages and combines their advantages. However, there is still a question of placement of the technology for hot water preparation. In order to reduce the losses incurred in hot water distribution, its sources are atomised and moved up to individual sections - to footings of buildings (houses), or are situated so that they supply the media to a small number of buildings within certain, usually short distance. With regard to spatial requirements, the rapid heating technologies are preferred.

In the real practice, two solutions are applied. In the first case, the primary water (of high temperature) enters the heat exchanger station (HES) where it directly transfers the heat to cold water through the heat-transfer surface. These stations are usually outside a consumption building, or at the footing thereof. Such connection is depicted in Fig. 3.

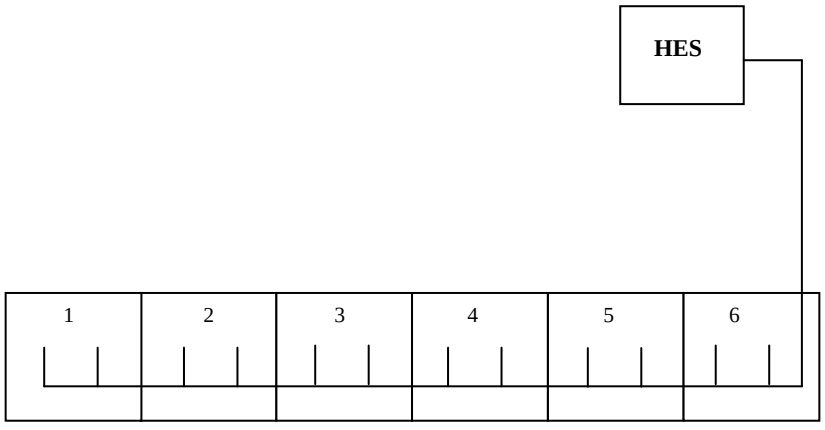

FIGURE 3: Connection of HES outside the consumption building (1, 2, 3, 4, 5, 6 – consumption buildings).

An advantage of the hot water supply solution described above is the reduction of circulation losses. The control system evaluates the hot water output temperature and adjusts the primary medium parameters to such temperature.

Another solution of water heating is placing the hot water preparation system directly at the customer's premises, i.e. in one or several sections. By placing heat exchanger stations directly in individual sections, due to the primary media parameters (p = 2.5 SPUa, t = 200 °C) it would be necessary to create a so-called nested circuit (small primary unit - SPU) with parameters adjusted so that the produced noise is not of high level. A disadvantage of such solution is the equipment placement directly in the customer's building. Another disadvantage is limited space for placing heat exchangers, regulation components, and cooperation of control systems. The technology with such connection is shown in Fig. 4.

In this technology, the central control system adjusts the parameters of the nested circuit (SPU1, SPU2) according to the requirement of the station with the highest immediate energy consumption. Other stations adjust these parameters according to their own requirements that are obviously lower. The result is that the nested circuit prepares the medium with the

maximum parameters practically all the time. This statement is confirmed also by the records from the 24-hour experiment (Fig. 5). They contain the development of temperature changes in time for one of the two pressure-dependent stations (for the small primary unit SPU1) which supplies hot water to three sections (1, 2, 3). It has its own regulation station. The second small primary unit (SPU2) supplies hot water to sections (4, 5, 6) and has its own regulation station, too.

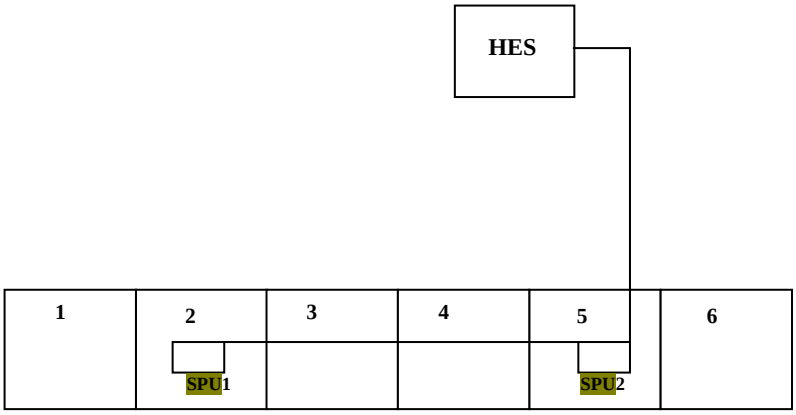

FIGURE 4: Connection of HES in the consumption building (SPU1, SPU2)

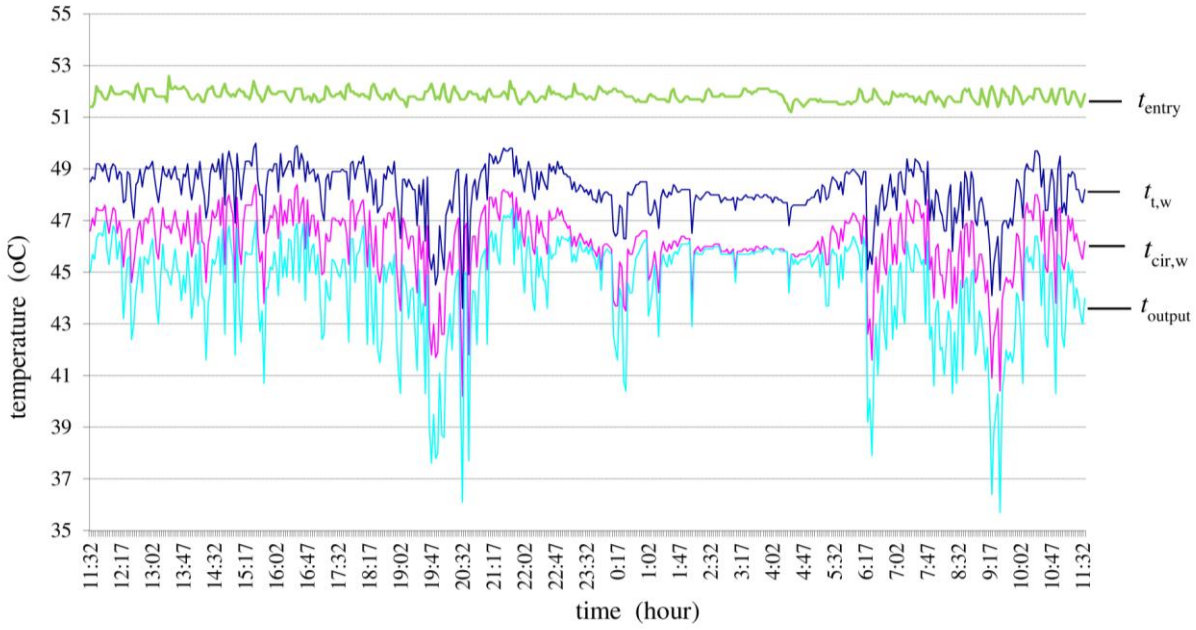

FIGURE 5: Measurement in the nested circuit of SPU1

IV. CONCLUSION

Time irregularity of the heat demand results in heat losses incurred to a supplier, representing as much as 30%. Such losses may be reduced by reducing the flow quantity of water in the nested circuit; this, however, is difficult because heating in such HES is also pressure-dependent.

The comparison of the two above described methods of hot water preparation (in terms of hot water supply quality, i.e. the temperature) indicates that the quality is high in both methods. The supply comfort is higher in pressure-dependent stations, mainly in terraced houses where various supply modes may be applied, depending on customer needs.

As for the comparison of the two technologies in terms of cost-efficiency, the second method (rapid heating with a nested small primary unit) with pressure-dependent stations is much more expensive and the losses caused by consumption irregularity are higher. It follows from the facts above that the heating method without a nested small primary unit is more advantageous.

ACKNOWLEDGEMENTS

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Performance evaluation of Activated Sludge Process in Dairy Waste water Treatment

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Abstract— *Wastewater from dairy industries generally has oils and greases in high concentration and contains high concentration of biochemical oxygen demand (BOD) and chemical oxygen demand (COD). This experimental study is being initiated to evaluate an Activated Sludge Process (ASP) with mixed bacteria for dairy waste water treatment. A three phase study was carried out by varying hydraulic retention time (HRT). The study is being undertaken in two steps in which the bacteria is being cultured in a medium by the process of acclimatization. The later stage will be the determination of the operating parameters. The characteristics of dairy industry waste water were studied and the performance was analyzed. A lab-scale ASP was set up for the study of the performance in treatment of effluent. The effect of various aeration time phases were analyzed in the lab scale Aeration Process for the HRT time of (2, 4, 6) hrs respectively. ASP efficiently removes BOD, COD and nutrients when designed and professionally operated according to local requirements. From the effects of various HRT, the 6 hrs HRT was more efficient in removal of the organic matter. The removal efficiency of COD, BOD and TSS were 97%, 97.5% and 96% respectively. In this process all the parameters were within the standard discharge limits. Hence, the enhancement of organic removal from dairy effluent using ASP was found feasible*

Keywords— Aeration, BOD, COD, Dairy Wastewater, HRT.

I. INTRODUCTION

A dairy industry processes the raw milk received from farmers so as to extend its marketable life or to prepare dairy products such as butter, cheese, yogurt etc. The two main processes are involved in the industry are pasteurization and homogenization. Pasteurization is the process of heating up milk either to 62° C for 30 minutes or 71° C for 15 seconds and then quickly cooling it down to 4°C. It eliminates the presence of certain bacteria such as Salmonella, E.Coli and Listeria which may be present in unpasteurized milk. Homogenization is a process which breaks down the fat molecules in milk so that they resist separation. The dairy industry is one of the largest sources of wastewater generation. The volume of waste generated from it is around one to three times the volume of milk processed in the industry. Roughly, every year around 3.739 to 11.217 million m3 of waste is generated from the milk industry. As the demand for milk is increasing in all the countries, the dairy industry is flourishing which ultimately leads to an increase in the generation of dairy wastewater.

II. ENVIRONMENTAL IMPACTS OF DAIRY EFFLUENTS

The organic components of the wastewater from the dairy processing operations can be classified as proteins, lactose and fat. These will affect the environment in different ways depending upon their biodegradability and solubility. Wastewater application to soil is a threat to the environment. Plant uptake of nitrogen amounts to up to 500 kg/ ha/ year. For phosphorous, the amount is about 30 kg of phosphorous. If animals subsequently consume the pasture, 90 % of the nitrogen and phosphorous is recycled to the pasture.

Losses of nitrogen (principally in the nitrate form) to groundwater can occur at some irrigation sites depending on the amounts of nitrogen removed by other means. The factor usually limiting the disposal of nitrogen containing wastes to soils is nitrate contamination of groundwater that is subsequently used as water supplies for humans or livestock.

Phosphorous usually does not cause a problem by leaching to groundwater because of the high retention and immobilization of phosphorous by the soil.

III. METHODOLOGY OF TREATMENT OF DAIRY WASTEWATER

The dairy wastewater sample was collected from the equalization tank at the effluent treatment plant in the dairy industry near Chennai. The fresh wastewater sample was collected and stored/preserved in 4°C to prevent changes in its properties. The activated sludge was collected from the secondary clarifier of the ETP in a dairy industry near Chennai and was used as the seed for the reactor. The acclimatization process was done by using this activated sludge. Chemicals and reagents used for the analysis and the study were Sodium Thiosulphate, Manganese Sulphate, Concentrated Sulphuric Acid, Starch solution and Alkaline Iodide.

A mechanical stirrer was used to uniformly spread the effluent and increased the contact between the effluent substrate and biomass during the aerobic phase. In anoxic phase, mechanical mixing alone had done without aeration in such a manner to uniformly distribute the biomass throughout the liquid phase. However, the oxygen absorption during anoxic operation was maintained as low as possible to prevent the destruction of the anoxic condition by maintaining the speed of the mechanical stirrer without creating much of turbulence.

The air pump was used in this study to supply air. TID-15 model pump was used which flow was 15 lpm, speed-1440 RPM and the motor capacity of 1/20 HP. Compressed air was supplied through the diffusers. A typical air requirement calculation for SBR design was mentioned

3.1 Experimental setup

For the present study laboratory scale with a total volume of 17.5 L (25cm x 20cm x 35cm) and working volume of 1.25 L, 2.5 L, 3.75 L, 5 L and 15 L were used. It was complemented by an influent feeding tank, and an air diffuser pump. The reactor was made up of acrylic plastic which was enabled easy observation and experimentation of settling or floatation behavior of sludge. Aeration was provided from the base of reactor by an air compressor. The photographic representation of experimental setup is shown in the fig 1.

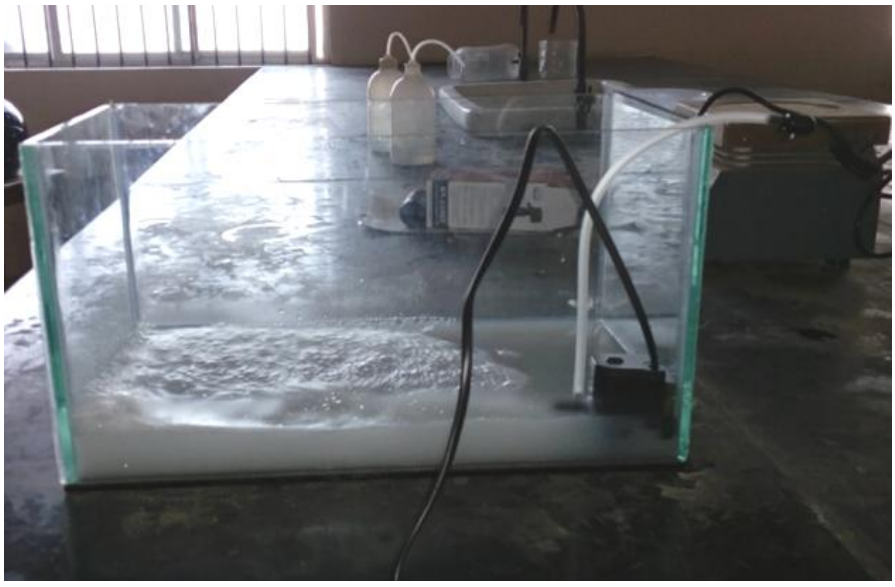

FIG. 1 EXPERIMENTAL SETUP OF AERATION PROCESS

The dairy wastewater was characterized before and after the treatment process. The parameters like chemical oxygen demand (COD), bio-chemical oxygen demand (BOD), pH, suspended solids (SS) were estimated using standard methods for the examination of water and wastewater.

3.2 Characterization of dairy wastewater

Dairy wastewater was characterized for various parameters and furnished in table.1 more than 3 levels of headings should be used. All headings must be in 10pt font. Every word in a heading must be capitalized except for short minor words as listed in Section III-B. The characteristics of dairy waste water before treatment.

TABLE 1
CHARACTERISTICS OF DAIRY WASTEWATER

S.No	Parameter	Raw wastewater Concentration	Existing aerated water concentration	CPCB Standards
1.	pH	8.98	7.32	5.5-9.0
2.	COD	3075	1872	250
3.	BOD	1020	624	30
4.	TSS	324	420	100
5.	TDS	858	663	
6.	Oil & grease	135	8	10

IV. RESULTS AND DISCUSSION

The wastewater sample was collected from the equalization tank daily at the effluent treatment plant and ASP process was conducted. The treated water collected from ASP tank and characteristics like COD, BOD, TDS and TSS. By using the ASP process, dairy wastewater sample was treated for time of 2 hrs for consequent days. The process was conducted for 3 times. Each cycle began with fill phase that was an anaerobic stage about 3.75 min (the reactor was stirred but not aerated). After the anaerobic stage there was an aerobic stage of 1.5 hrs, with stirring and aeration, for nitrification. The next phase of 7.5 min was anoxic for de-nitrification, with stirring but no aeration. The cycle should have finished at the following stages of settling and decant phase of 15 min & 3.75 min respectively. The treated water was collected from the SBR tank and the following parameters like COD, BOD, TDS and TSS were estimated from all the samples.

TABLE 2
EFFECT OF 2HR ASP'S HRT ON REMOVAL OF BOD, AND COD

Parameter	Raw effluent concentration*	Treated effluent concentration*				% of removal	CPCB standards
		S_1	S_2	S_3	Mean		
Ph	8.5	7.1	7.3	7.0	7.1	-	5.5-9.0
COD	3350	395	360	380	378	88.7	250
BOD	1700	55	48	45	49	97.1	30
TSS	1150	145	110	130	128	88.9	100
TDS	858	229	230	225	228		195

(Note: All the parameters are in mg/L except pH)

Comparing to the existing treatment method, ASP process was removed more amount COD, BOD from the dairy wastewater. % of removal was from 60 to 75 %.The Effect of 2 hrs, 4 hrs and 6 hrs ASP's HRT on removal of BOD and COD is shown in table 2, 3, 4.

TABLE 3
EFFECT OF 4HR ASP'S HRT ON REMOVAL OF BOD, AND COD

Parameters	Raw effluent concentration*	Treated effluent concentration*				% of removal	CPCB standards
		S_1	S_2	S_3	Mean		
pH	8.5	7.1	7.3	7.0	7.1	-	5.5-9.0
COD	3350	305	325	290	307	90.8	250
BOD	1700	45	35	30	37	97.8	30
TSS	1150	105	95	80	93	91.9	100
TDS	858	194	197	197	196		195

(Note: All the parameters are in mg/L except pH)

TABLE 4
EFFECT OF 6HR ASP'S HRT ON REMOVAL OF BOD, AND COD

Parameter	Raw effluent concentration	Treated effluent concentration*				% of removal	CPCB standards*
		S_1	S_2	S_3	Mean		
Ph	8.5	7.1	7.3	7.0	7.1	-	5.5-9.0
COD	3350	240	265	230	245	92.7	250
BOD	1700	25	28	20	24	98.6	30
TSS	1150	95	89	86	90	92.2	100
TDS	858	187	189	191	189	78	195

By comparing the various HRT in ASP process, the HRT of 8 hrs was found to be more efficient than the other HRT of 2 and 4 hrs. COD, BOD, TSS removal also achieved in the time of 6hrs. The organic matter removal efficiency for the HRT of 6 hrs was in the range of 93 to 99 %. So the HRT of 6hrs was found to be more efficient and better than the other 2 HRT. Effects of HRT on organic matter removal are shown in fig 2, 3 and 4.

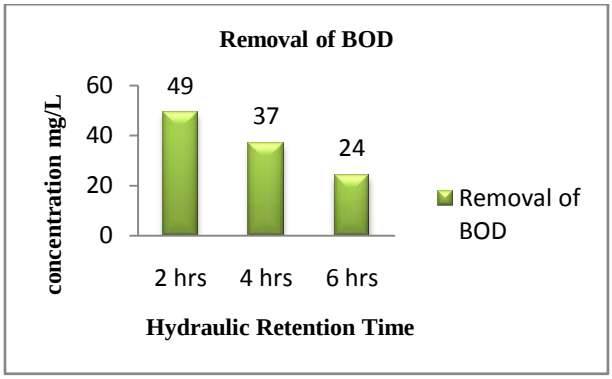

FIG. 2: EFFECTS OF VARIOUS HRT ON REMOVAL OF BOD

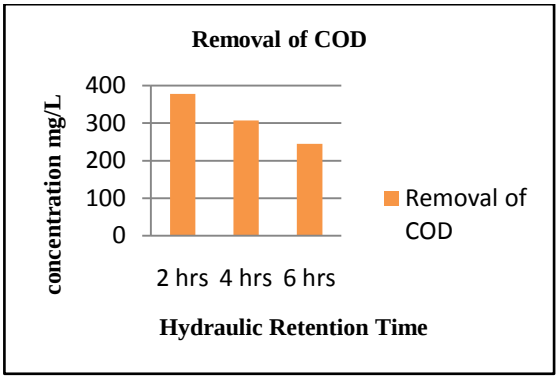

FIG. 3: EFFECTS OF VARIOUS HRT ON REMOVAL OF COD

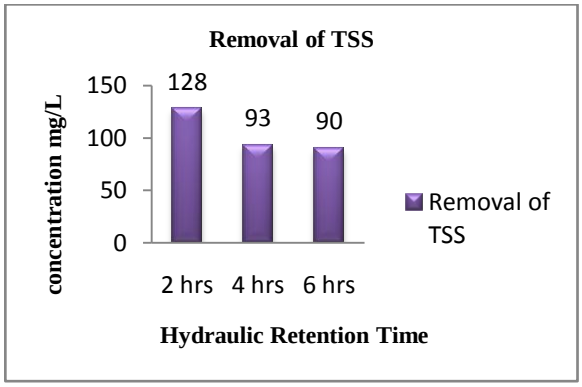

FIG. 4: EFFECTS OF VARIOUS HRT ON REMOVAL OF TSS

V. CONCLUSION

The enhancement of COD, BOD removal from the dairy effluent by the ASP process was found feasible and was in the range of 80 to 96 % and the HRT of 6 hrs was found to be more efficient. The process of acclimatization was found to be more feasible in the development of bacteria in this study.

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A brief review on augmented reality based google glass

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Abstract**—***Augmented reality that is Wearable technology is fast becoming a part of our technological life. There are many devices, from dresses to headphones that can record your day-to- day life. The maturing field of wearable computing aims to inter- weave computing devices into everyday life. This report focuses on smart glasses, one of the categories of wearable computing devices which is present in the media. This paper provides a concise overview of the history and context of Glass based on AR technology. The intended purpose of smart Glass products would be the hands-free displaying of information currently available to most smartphone users, and allowing for interaction with the Internet via natural language voice commands.*

Keywords—augmented reality, hands-free, smart glasses, smartphone, wearable technology.

I. INTRODUCTION

People are increasingly moving away from desktop computers and latching on to smartphones and tablets. The entire world is just focused on their phone in front of them. The reason behind this is that we want to connect to other people in our life; we want to connect to information. So the question is 'Should it be by just walking around looking down?'. Project Glass or smart glass is one answer to that question. Project glass is a research and development program by Google also called as Google glass, started by BabakParviz, director of Google. The intended purpose of google glass would be the hands free displaying of information currently available to most smartphone users.

II. LITERATURE SURVEY

Based on Eye-Tap technology developed in 1990s. It is similar in appearance to Google Glass. It is perceptibly bulkier and less elegant; the older, larger computer parts attached to the thin aluminum frame assert themselves more aggressively against the organic life-form behind them. It functions differently, although some of the applications are the same.

What is google glass?

Google Glass is simply a wearable computer with optical head mounted display(OHMD) that looks like a pair of glasses and lets users accomplish various tasks and receive quick information in a smartphone form. The difference is that Google Glass is used hand-free and does not require the user to look away to receive information, which is officially called a heads-up display. Google Glass was created to ease the user's daily and social life by taking the bulky and physical part of technology out of the way to help the user connect to the world in a faster way. It is connected to the Internet, and the user can take photographs, record videos, send and receive messages, and stream live recordings, amongst others.

III. PARTS OF GOOGLE GLASS

Google Glass consists of a lot of the same parts that you would find inside of a smart phone. Google Glass has a 640×360 prism projector display, a CPU, sensors, GPS, a bone transducer speaker, a battery, a touchpad, 2GB of ram, 16GB of storage, and a camera. All of these components are attached to a frame that is worn by the user. It has features with the small video display which is used to display the hands free information by pop up. It also has the video camera with front facing through which we can take photos and videos in a glimpse. Google glasses are designed to be hands free wearable device that can be used to make or receive calls via a bone conduction transducer. Single button on the side of the frame sophisticates the glasses to work with the physical touch input.

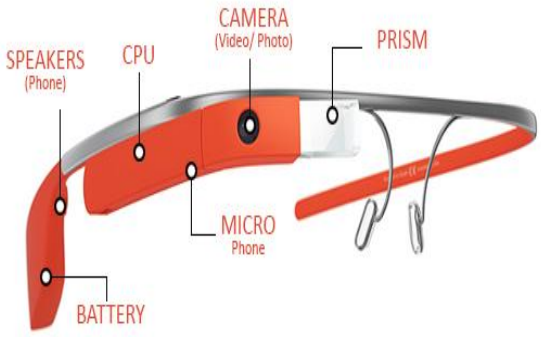

FIGURE 1: Parts of Google

3.1 How Does Google Glass Work

Google Glass operates in a pretty simple fashion. Users connect Google Glass to their phone and Google Glass receives different information from that phone to provide notifications and information to the wearer. These notifications include things like incoming email alerts, call alerts, text message alerts and other notifications like that. These notifications are displayed to the user via the prism on Google Glass that rests over their right eye. Users can access different options and different notifications by using the touchpad on the device or by using voice commands. Like a smart phone, applications that serve different purposes can be installed on the device and can be accessed via the touchpad and voice commands. Basically, the way that Google Glass works is sort of the same way that a smart phone works. Users access different information and applications and those things are displayed to them on the screen. The only thing that is different about Google Glass when compared to a smart phone is that the information is being displayed to the user via a prism located above their eye.

3.2 What google glass does?

Users can start using the device by tapping on the touchpad or by saying the words "Ok Glass". Ok Glass is a voice command that is used to select and launch different applications. It's also used to perform different actions. Once a user taps on the touchpad or says "Ok Glass", the display above the right eye will show the user the home screen. The home screen isn't anything special, it's just a list of different applications, actions, options and settings. From the home screen, Google Glass owners can launch an app, record a video, take a snapshot, or call someone, for example. Users can select these different things by using the touchpad or by saying the command "Ok Glass", followed by what they want to do. So, for example, "Ok Glass, take a picture" will have Google Glass take a picture. So, Google Glass is controlled by using the touchpad on the right hand side of the device and by using voice commands

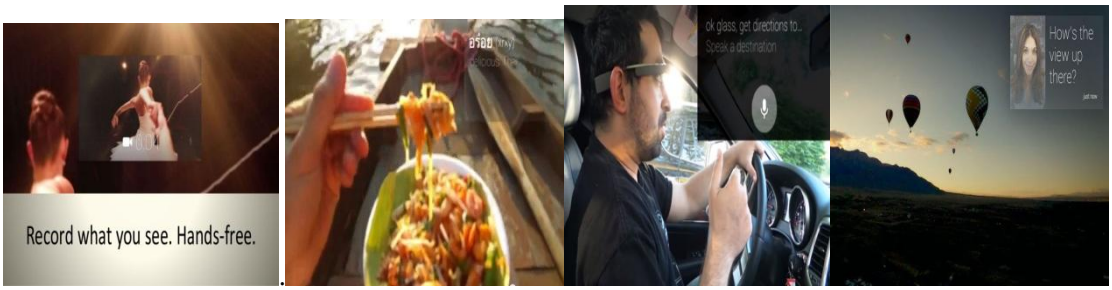

FIGURE 2: Google glass

IV. FUTURE SCOPE

Market Estimations:- BI Intelligence, at the beginning of the 2014, estimates of sales for the next few years that arrive to the interesting figure of 21 million units for the year 2018, all depending on various factors such as the price is, interest and attraction of developers by creating new applications and the cultural barrier to social acceptance the everyday use of this device (privacy, snobbery, design).

With the upcoming technology, google has promised a new google glass that will hit market in 2019.

V. CONCLUSION

Google glass is wearable computer. This brings ease and sophistication at life. As google glass is used as Smartphone like hands free format it makes life simple. The technology behind Google Glass is impressive. It takes communication to next level.

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Statistical Analysis Approach to Reduce Inter Channel Interference by using Kalaman Filter in term of BER & SNR

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Abstract— *Many wireless networks have adapted the same communication approach. The OFDM communication is very much inspired from the channel frequencies over the network. In such a network some kind of orthogonal distortion occurs over the channel called Inter Carrier Interference. In this work, we are presenting the concept of mathematical model called Kalman filter to analyze the signal interference and to resolve the problem. In first phase the signal is analyzed for the disruption using Kalman filter and adaptive filter is implemented to reduce the ICI over the signal. The mathematical analysis is performed by using Extended Kalman filter. The result analysis has been performed with respect to BER and the SNR. A novel spatial Kalman filtering scheme is proposed as the second stage to successively cancel the ICI. Simulation results show the effectiveness of the proposed two-stage method and its robustness to channel estimation uncertainties that may arise in practical systems.*

Keywords— Decision-feedback equalization, digital communications receiver, frequency selective time-varying fading channel, interference suppression, iteration detection, Kalman filter.

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is a multicarrier modulation (MCM) technique which seems to be an attractive choice for fourth generation (4G) wireless communication systems. OFDM offers high spectral efficiency, immunity to the multipath delay; low inter symbol interference (ISI), immunity to frequency selective fading and high power efficiency. Due to these merits OFDM is chosen in high data rate communication systems such as Digital Video Broadcasting (DVB) and based mobile worldwide interoperability for microwave access (mobile Wi-MAX). However OFDM system suffers from serious problem of high PAPR. In OFDM system output is superposition of multiple sub-carriers. In this case, some instantaneous power output may increase to a large extent and may become far higher than the mean power of the system. To transmit signals with such high PAPR, it requires power amplifiers with very high power scope. These kinds of amplifiers are very expensive and have low efficiency. If the peak power is too high, it could be out of the scope of the linear power amplifiers. This gives rise to nonlinear distortion which changes the superposition of the signal spectrum resulting in performance degradation. If no measure is taken to reduce the high PAPR, MIMO-OFDM system could face serious restriction in practical applications. PAPR can be described by its complementary cumulative distribution function (CCDF). In this probabilistic approach certain schemes have been proposed by researchers. These include clipping, coding and signal scrambling techniques. Under the heading of signal scrambling techniques we have included two schemes included [1],[2].

The OFDM has many advantages such as high bandwidth efficiency, robustness to the selective fading problem, use of small guard interval, and its ability to combat the ISI problem. So, simple channel equalization is needed instead of complex adaptive channel equalization. Apart from various advantages of OFDM, there are certain disadvantages also. The frequency offset of the sub-carriers and the high PAPR are the major drawbacks of OFDM [3].

OFDM is a modulation technique in that it enables user data to be modulated onto the tones. The information is modulated onto a tone by adjusting the tone's phase, amplitude, or both. In the most basic form, a tone may be present or disabled to indicate a one or zero bit of information, however, either phase shift keying (PSK) or quadrature amplitude modulation (QAM) is typically employed. An OFDM system takes a data stream and splits it into N parallel data streams, each at a rate 1/N of the original rate. Each stream is then mapped to a tone at a unique frequency and combined together using the inverse fast fourier transform (IFFT) to yield the time domain waveform to be transmitted.

II. BENEFITS OF OFDM

Orthogonal FDM's (OFDM) spread spectrum technique distributes the data over a large number of carriers that are spaced apart at precise frequencies. This spacing provides the "orthogonality" in this technique which prevents the demodulators from seeing frequencies other than their own. The major benefits of OFDM system are

- High spectral efficiency
- Resiliency to RF interference
- Lower multi-path distortion

OFDM is sometimes called multi-carrier or discrete multi-tone modulation. It is the modulation technique used for digital TV in Europe, Japan and Australia. The major uses of OFDM system are:

- Wireless Local Area Networks development is ongoing for wireless point-to-point and point-to-multipoint configurations using OFDM technology.
- In a supplement to the IEEE 802.11 standard, the IEEE 802.11 working group published IEEE 802.11a, which outlines the use of OFDM in the 5.8-GHz band.
- DAB - OFDM forms the basis for the Digital Audio Broadcasting (DAB) standard in the European market.

OFDM, or multitone modulation is presently used in a number of commercial wired and wireless applications. On the wired side, it is used or a variant of digital subscriber line (DSL). For wireless, OFDM is the basis for several television and radio broadcast applications, including the European digital broadcast television standard, as well as digital radio in North America. OFDM is also used in several fixed wireless systems and wireless local-area network (LAN) products. A system based on OFDM has been developed to deliver mobile broadband data service at data rates comparable to those of wired services, such as DSL and cable modems.

III. SYNCHRONIZATION IN OFDM SYSTEMS

When the modulated signal is received, it has propagated a distance which is unknown to the receiver. This means, that three parameters are all unknown; the phase of the carrier, the phase of the sample clock, and start time of the transmitted signal.

Synchronization has to be done before demodulation at OFDM receiver. It is a complex and extensive field, and is made possible by introducing a marker or synchronizing sequence at the transmitter. Here an overview of two synchronization problems; carrier frequency and symbol or time synchronization is given.

3.1 OFDM System Model:

A baseband OFDM signal can be represented by [1]

$$b(t) = \sum_{i=1}^{N-1} A_i \cos(\omega_i t + \phi_i)$$

Where A_i is the amplitude, $w_i = 2\pi f_i$ is the angular frequency, ϕ_i is the phase of the i^{th} sub-carrier, and N is the number of sub-carriers. According to the modulation technique to be used, either A or ϕ is determined by the data. Now, the baseband OFDM signal b(t) is modulated next, onto a RF carrier with frequency f_c

$$\begin{aligned} s(t) &= 2b(t)\cos\omega_c t \\ &= 2\sum_{i=0}^{N-1} A_i \cos(\omega_i t + \phi_i)\cos\omega_c \\ &= \sum_{i=0}^{N-1} A_i \left\{\cos\left[(\omega_c + \omega_i)t + \phi_i\right] + \cos\left[(\omega_c - \omega_i)t - \phi_i\right]\right\} \end{aligned}$$

:

Where $w_c = 2\pi fc$, and we assume the phase of the carrier to be zero for simplicity. Since a single side band transmission is enough to carry the information in Ai or ϕ_i , it is assumed that the upper sideband is used, and therefore the transmitted signal can be represented as

$$s(t) = \sum_{i=0}^{N-1} A_i \cos\left[(\omega_c + \omega_i)t + \phi_i\right]$$

In this section the theoretical analysis of the effects of frequency errors is presented. The maximum Doppler shift occurs when the two mobile nodes move toward each other, given by [6]

$$f_d = \frac{vf_c}{c}$$

Where v is the relative speed of the two nodes, f_c is the carrier frequency and c is the speed of light (3 X 10^8 ms). An OFDM signal consists of numerous sub-carriers with different frequencies. The amount of Doppler shift affecting the i_{th} sub-carrier is given by [7]

$$(f_c \pm f_i) \longrightarrow (1+\xi)(f_c \pm f_i)$$

Where ξ is the percentage of the change in frequency and is determined by

$$\xi = \frac{f_d}{f} = \frac{v}{c}\cos\theta$$

The right-hand side of below Equation can be written as

$$(1+\xi)(f_c \pm f_i) = (1+\xi) f_c \pm (1+\xi) f_i$$

Which demonstrates that the Doppler frequency shift affects the carrier frequency and the sub-carrier frequencies by the same percentage ξ . The Doppler shift of the carrier frequency can be calculated as

$$f_{dc} = \frac{vf_c}{c}\cos\theta$$

and the Doppler shift of the sub-carrier frequencies as

$$f_{di} = \frac{vf_i}{c}\cos\theta$$

By using Equation again, the transmitted OFDM signal with Doppler shift can be written as

$$s(t) = \sum_{i=0}^{N-1} A_i \cos\left[(1+\xi)(\omega_c + \omega_i)t + \phi_i\right]$$
$$= \sum_{i=0}^{N-1} \left\{ A_i \cos\left[(1+\xi)\omega_i t + \phi_i\right]\cos\left[(1+\xi)\omega_c t\right] - A_i \sin\left[(1+\xi)\omega_i t + \phi_i\right]\sin\left[(1+\xi)\omega_c t\right] \right\}$$

In Equation, $A_i \cos[(1+\xi)\ w_i\ t + \phi_i]$ can be thought of as the envelope of the carrier, $\cos[(1+\xi)\ w_c\ t]$, which helps to demonstrate that the Doppler shift affects the envelope and the carrier frequency by the same percentage The Doppler shift also affects the symbol rate and the time synchronization.

3.2 Carrier Synchronization in OFDM System using Kalaman Filter

Due to the carrier frequency difference Δf of the transmitter and receiver, each received sample at time t has an unknown phase factor given as $e^{j2\pi\Delta ft}$. Carrier frequency offset in OFDM system causes the loss of orthogonality of the sub-carriers (ICI), reduction of signal amplitude (the sinc function is shifted and no longer sampled at the peak), and degrades the performance of the system. Thus, the unknown phase factor must be estimated and compensated for each sample before the FFT process.

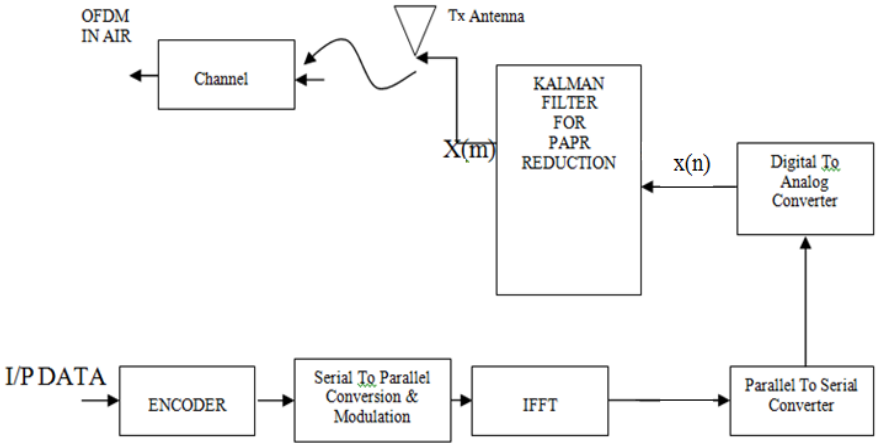

FIGURE 1: Block Diagram of OFDM Transmitter

Kalman filter is basically designed as a generalized solution to the common problem. It is about to estimate the state of discrete time controlled process by using the basic concept of differential equations. The symbol duration must be fixed in such a way that the overhead associated with the guard time is minimal. This can be achieved by making the symbol duration much longer than the guard time. However large symbol duration means more number of sub-carriers and thus causes implementation complexities and increased peak-to-average power problems. Thus a practical design choice for the symbol duration is around 5-6 times the guard time.

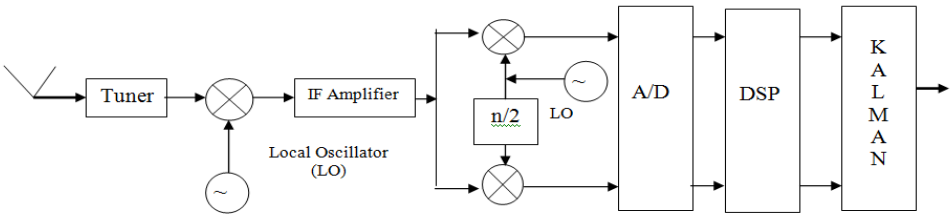

FIGURE. 2: Block Diagram of OFDM Receiver

IV. SIMULATION RESULTS

In this section, we verify the theory by simulation and we Test the performance of the iterative algorithm.

In figure, comparative analysis of PAPR reduction is shown using Kalman Filter. In this work we have implemented a two stage Kalman Filter. The first stage is about to reduce the PAPR. The results shows that the presented approach is more effective with less SNR over the signal.

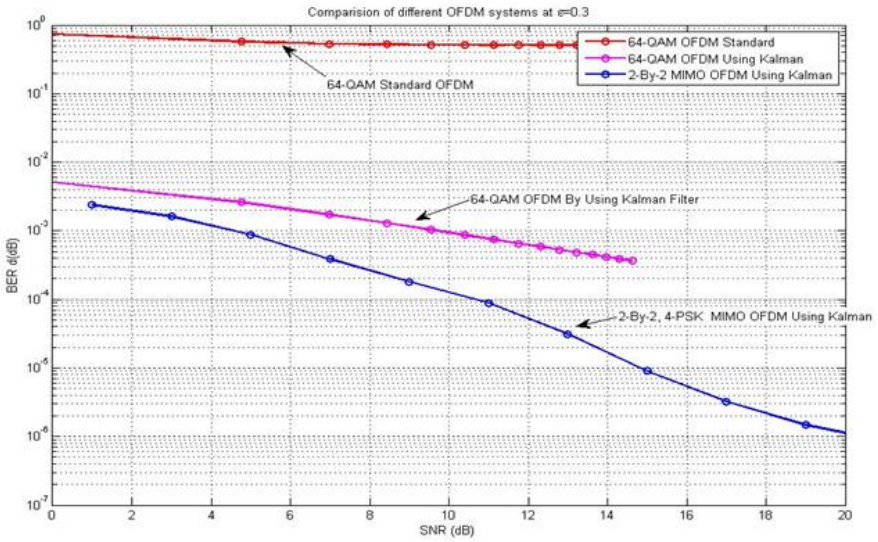

FIGURE 3: Comparison graph of OFDM Techniques

When data travel over some channel it suffers from the problem of interference. The interference results the high signal to noise ratio as well as high bit error rate. The proposed system will improved the signal by removing the different kind of impurities over the signal. These impurities include the ICI, PAPR and the noise over the signal. The signal will be more effective than standard OFDM.

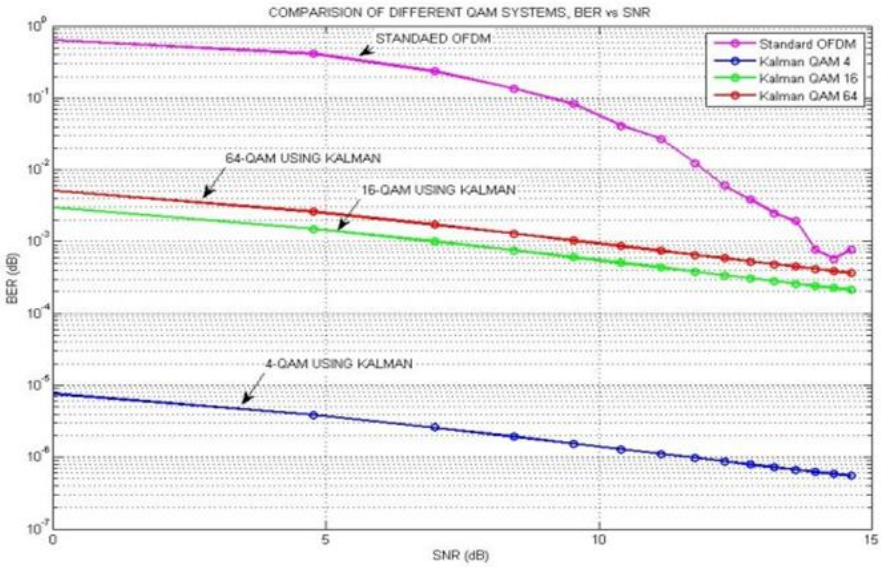

FIGURE 4: Simulation Results of OFDM Technuques

V. CONCLUSION

In this project, the performance of OFDM systems in the presence of frequency offset between the transmitter and the receiver has been studied in terms of the Carrier-to-Interference ratio (CIR) and the bit error rate (BER) performance. Inter-carrier interference (ICI), which results from the frequency offset, degrades the performance of the OFDM system.

One method is explored in this project for mitigation of the ICI i.e. ICI self-cancellation (SC). By using this method the BER is improved in comparison to simple OFDM system.

In this project, the simulations were performed in an AWGN channel. This model can be easily adapted to a flat-fading channel with perfect channel estimation. Performing simulations to investigate the performance of this ICI cancellation schemes in multipath fading channels without perfect channel information at the receiver can do further work.

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