iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** IX **Month of publication:** September 2021

DOI: https://doi.org/10.22214/ijraset.2021.38048

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue IX Sep 2021- Available at www.ijraset.com

Super Absorbent polymers and their Composites for Application in Agriculture

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Abstract: In dryland agriculture, Superabsorbent Polymers (SAPs) are popular. However, the mechanical property, repetitive soil water absorption and release, regularly affects the water retention and hydraulic parameters of the soil, and since this property decreases progressively over time, the results of the property appear to be unpredictable. Polymers use to in agriculture field.

I. INTRODUCTION

Polymers are the long chains which are formed by connection of repeating subunits, known as monomers. Monomers are molecules of any compound that bind to form polymers with the similar or other compound subunits. However, the term composites implies for mixture of different materials with equal physical or chemical properties or with various physical or chemical properties **(**Liao, et al.,2016)**.** Polymers are of two types, natural and synthetic. Synthetic polymers are made up of petroleum and man-made. And there are many examples of synthetic polymers like Teflon, epoxy, nylon etc. The natural polymers are numerous and available in nature. These polymers promote the growth of crops and farmers use them to improve agriculture (Nnadi et al., 2011). However, there are a lot of polymers that are dangerous to agriculture like polyvinylchloride (PVC).

Agriculture is helpful in achieving three goals: i) save our natural resources, ii) meet the social need of growing population iii) livelihood for farmers. Among agricultural crops, vegetables belong to cash crop group **(**Tomczykowa et al., 2019)**.** The important properties of this group is that the produce of crop is supplied as final product in the market and the capital return period of the products of this group is very short. Thus, the farmers are more inclined to plant cash crops. Therefore, there is need to work on economic and environmental aspect (Nnadi et al., 2011)**.** Product from agricultural crops is one of way to raise some funds. There are two kinds of natural and synthetic polymers. Petroleum and scientists produce synthetic polymers for day-to-day use. There are also several types of synthetic polymers such as teflon, epoxy, acrylic, and natural polymers. Natural polymers are related to milk, silk, cellulose and proteins. Polymers play an important role in agriculture, which creates an atmosphere which benefits the plant development, so that we can have polymers from green source and can be used as irrigation polymers, fumigation polymers and mulching polymers. Modern agriculture involves the intensive use of land and the use of high-quality artificial fertilizers to enable farmers to achieve sustainability objectives, such as the conservation of natural resources and, secondly, the fulfilling of the needs of the growing population while remaining financially viable to growers and consumers. One polymer has various properties and can be used economically in agriculture as well. Polymeric molluscicides, which are often used in fighting different molluscs to increase snail eradication. The Super absorbent polymers (SAP) second most significant polymers are able to absorb large amounts of water and spread to form gel fragments acting as small moisture reservoirs in the ground and, by pressurized application to roots of the plants in gel form. It prevents the water evaporation to the atmosphere. Green house also acts to protect crop is an envelope device covered with glass or plastic film in which the plants are cultivated or named a protected environment in a specific setting. If the temperature is mild, we can regulate the environment in these houses to maximize productivity, and this helps to improve production. Green houses are often used as defensive farming for crops under various weather conditions. The properties of plastic are very distinct. It also supports food processing and is also good for long-distance travel. A variety of PVC forms are available. Some of the plastic materials used in the fruit packaging are LDPE, PP and HDPE. Plate for gripping and proliferation in nurseries is also made up of polymer. In grafting polythene strips, stocks and scion in a pet pack, plug board, cage and a hanging basket also used polymers. This contributes to handling and also to planting, transplanting and transportation. The most important polymers in focuses are SAP, classified as polymers that are super absorbent. Another polymer are hydrogel that consists of synthetic materials. For the growth of crops this is a essential food. It is very beneficial for the ecosystem and reduces drought and contributes to the elimination of contamination from groundwater. The hydrogel not only contributes to the reduction of drought, but also reduces the effect. The time frame is a water absorbent polymer thus, there are numbers of hydrogels. The third and fourth type of polymers are polyacrylate potassium and slush powder sometimes named first super absorbent polymers.

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Latter can absorbs huge quantities of a liquid and retains its own mass with greatest versatility. A sodium neutralization procedure is used to package the water molecules into the vessel. In this step, hydrogen binding keeps the water so closely bound. The second pusa is a semi-synthetic and super absorbent polymer that also fixes the need for water needed by the plant and also helps to expand the plant. The third thing we have polyacrylate potassium is retained and has a very helpful hydrogel, in seasonal crops. In transport trees, flowers, horticulture and gardening and the landscape, that is very helpful. This polymers are helpful in the dry season and rainy period, since many farmers want to save their cultivation and may also use this polymer in the weather changes when the season changes and damages the crop so that farmers will be able to save crops and its polymer can help grow the plants after use of this polymer. It is very useful for the soil and these polymers are called soil conditioners by many farmers. In order to keep their land from being eroded, many farmers are using these polymers as a way of reducing soil property and eroding. The majority of these polymers have been converted to gel that has increased their ability to hold water. This paper focus on superabsorbent type of polymers.

II. SUPER ABSORBENT POLYMERS

Water scarcity and desertification are major issues in many parts of the world because, first and foremost, they are unsustainable due to water scaricity (Milani et al., 2017). The most useful absorbent polymers in agriculture are prepared by solution or suspension polymerization from acrylic acids and cross-linking agents, such as potassium. Non-toxic, non-irritative, non-corrosive polyacrylates are screened such that they have 10–15 percent degradation rate per annum. It is a functional polymer with a strong capacity to absorb water and retain water. The most advantageous property of super-absorbent polymers lies in absorbing liquids several hundred times than their body weight and turning it into a gel. Therefore, it will keep or avoid the water loss from soil. The new group of water-savings and soil-conditioners, SAPs were widely adopted in agriculture, but their success in repetitive uses and other factors affecting the efficiency of SAPs are little understood. The goal is to determine the water capability of water absorption under various conditions such as purified water, tap water, extraction of the soil as a distilled water and soil mix, soil collection as a tap-water and soil mix, different temperatures and different soil-drying grades. Four different types of industrial soaps, marketed BF, JP, BJ and WT, have been taken the repeated absorption levels of water in the tap waters, distilled water mixture and soil and tap water mixture and soil mixture is decreased by 73–99 % compared to that of distilled water after five absorption processes. In addition, water quality was more effective than soil extraction in its initial water absorption. With SAP concentration, water absorption increased and these increases thereafter decreases with repetitive use. Repeated water absorbance at different temperatures (50°, 25° and −4°C) did not show major variations. For a prolonged time, the drying degradation of the hydrogels was less or equal to 80%, SABs retained an excellent hydrophilic capability. Initially, JP, supplemented by WT and BF, are known to maintain water absorption. The least absorption was seen by BJ. Repeated use efficiency varied depending on consistency of absorption, gel composition, concentration of sap, water content and soil humidity. The use of JP and WT macromolecules in order to increase crop quality under dry-hydrated conditions may be recommended for farmers.

III. SUPERABSORBENT POLYMERS AND THEIR APPLICATIONS FOR SOIL

In addition to fertilisers, all agricultural operations need an irrigation maintenance system to provide the soil with adequate nutrients. In arid countries, irrigation processes are particularly costly, which makes certain polymer materials impossible to conduct. This has made it an appealing option to solve this issue by using SAP hydrogel, since they give the requisite cost savings and continual irrigation characteristics for this technique (Avi Shaviv, 2001**)**. In the presence of water, septic tanks can swell and maintain water solutions and maintain soil moisture over longer periods (Shaviv et al., 1993). The use of SAPs in farming processes has, surprisingly, increased. SAPs for biologically use, including contact lenses, baby paintings and tamponing for the person, are well explained in the literature. SAPs have proved to be a great solution to drug encapsulation for delivery systems recently **(**Behera et al., 2020**)**. The ability for bio-compatibility has been improved by previous uses and derived from the swelling of SAPs, which guarantees a large water absorption potential (Alemzadeh et al., 2002). First Erickson mentioned the use of a soil conditioner SAP. In exchange, Redenbaugh researched its roles to encapsulate agrochemicals in the soil and eventually release them (Du et al., 2006). In addition, the roots of the SAPs are closely linked to their use, i.e. the properties of saps warrant further study as a fruitful area of inquiry. The purpose of this study is to provide constructive review contributions in this field of expansion in the overall view of SAPs and in particular their agricultural applications. For this reason, the features of SAP and the literature on their use and application for a controlled fertilizer release as a soil conditioner will be clarified.

IV. AGRICULTURE AND FUNCTIONAL POLYMERS

Acrylic acid is produced by propene, which is a by-product of the production of ethylene and gasoline. Therefore, polyacrylate is a non-renewable material that depends on the fuel industry. Synthetic polymers are used as structural materials in agriculture to create a plant-friendly ecosystem such as paves, shelters or greenhouses, as well as for fumigation, irrigation, for water transfers and controls (Peteu et al (2010)).

The main criterion of the polymers used for these applications concerns the material's physical characteristics, such as transmissibility (Reddy et al., 2013). In recent years, the science and technology of active polymers have been gaining popularity as one of the most exciting areas of polymer chemistry for the production of better materials. They were really successful. Applications as functional items based on active working groups 'benefits and a different world.

Their popular applications include a wide range of areas, including solid-phase synthesis, biologically active systems, and a number of other applications.

These polymers spread to about 200-800 times their original volume during watering and can absorb, store future irrigation water or rains and then gradually emit crop demands for a relatively lengthy period between water applications. Moreover, polymers can increase water absorption property of soil and the ability to conserve fertilizers and so economies on irrigating, when combined with the ground structure and generate superior air permeability (Dabhi et al., 2013).

V. BIODEGRADABLE POLYMERS IN AGRICULTURE

Biodegradable polymers are increasingly being used as plastic alternatives in a number of agricultural applications (Vroman and Tighzert, 2009). The presence of parasites in the soil is one of the issues that plague agricultural production. Take away nutrients from the soil, along with weeds that spring up on their own. In the past, parasite removal was a difficult task and the seeds of unwelcome plants. Solarization ensures that soils designated for insemination are decontaminated within 4-6 weeks (Chandra, 1998). The issue of film removal and disposal must be addressed at the completion of the procedure. Synthetic polymer films should be viewed as waste, incurring extra costs (Liechty et al., 2010). Furthermore, there are a variety of questions. One of the environmental challenges in the previous ten years was the rising usage and subsequent disposal of plastic products. Plastics are employed with little regard for their eventual disposability in countless applications. For many years after disposal, conventional polymers, such as polyethylene and polypropylene survive. These polymers, built for long distance, appear unsuitable for applications in which plastic is utilized and afterwards disposed of for short durations. In addition, foodstuffs and other biological things are typically dirty in plastics.

VI. POLYMERS THAT MINIMIZE DRAG IN AGRICULTURE

If large polymer molecules, fibers or particles in small amounts are found in a fluid, their friction resistance decreases with respect to the fluid alone. Dragging polymers reduce the drag in turbulent streams (through an unclear mechanism), while increasing shear viscosity increases drag in a laminar stream. Increased viscosity of shear increases drags in the laminar flow (Puoci et al., 2008).

VII. AGRICULTURAL POLYMERS MARKETS OF POLYMERIC MATERIALS

The above-mentioned paradigm change in material design opens up new markets for agricultural polymer materials. Cost and efficiency criteria, on the other hand, would determine whether or not anything is done, and to what degree. Present goods will be displaced by these new materials in near future.

A. Polymer Materials for Agriculture

Biopolymers used in foodstuffs that can be converted to biodegradable and environmentally safe plastics (Chang et al., 2020).

B. Polysaccharides

Starch mostly from maize, was the dominant agricultural biopolymer for biodegradable plastics conversion. Amylosis is around 1 million in molecular weight and 10 million or more in amylopectin molecular weight. In different concentrations, the two elements, amylose and amylopectin. However, the molecular structure of the starch is disturbed if its components are heated over the glass transition and melting temperature in the presence of water and pressurise, and the resulting substance exhibits heat-plastic properties. Polymer compositions incorporating this destruction of heat-plastic starch have been produced for various applications. These resins can be blown onto film, moulded and thermoformed by injection. In the previous segment on biodegradables plastics markets, the target markets for such plastics is addressed.

VIII. AGRICULTURAL APPLICATIONS

Low water retention capacity, high evapotranspiration rate and soil laughter are the three most frequent conditions which hamper plant growth and crop yield (Lithner 2011). In addition, the overuse of synthetic fertilizers and pesticides and excessive irrigation practices adversely impact soil and plants, as well as unforeseen conditions for erosion, decay and saltation, often causing irreversible harm to the soil of the biota (Han et al., 2013). The use of superabsorbent based on synthetic polymer in agriculture posed significant questions about the deterioration of the environment and the economic problems. Thus, the substitution of natural materials may serve as an inexpensive alternative for manufactured goods, which could be innovative and approximately easy to treat. There were some papers on the synthesis and use for farming use of superabsorbent hydrogens (Zăinesc et al (2016). In soil delay, crop and plant growth, as well as continuous biota destruction, low water retention, moisture release, and high development transpiration. In order to improve the water quality and the soil's nutrient retention ability, the horticultural sector has effectively applied super-absorbent hydrogels. Hydrogels based on edible polymers are ideal for water protection as soil additives. Moisture preservation, biodegradable, biocompatible in tropical and subtropical areas. Potential uses of hydrogens in farming include fertilizer carry, soil moisture, accumulation of water, irrigation reduction of water consumption (Mark et al., 2005). Network framework polysaccharide, which enhances even its properties. The preparation of hydrogels for agricultural applications included different kind of edible polymers, such as starch, cellulose, chitosan, CMC, alginates, pectin, etc. For slow releases of urea as a fertilization to boost soil properties, the starch dependent superabsorbent hydrogel with the moisture prevention property has been published. The fertilizer release rate was determined by gel intensity, microstructure and water absorption. Montesano et al. studied the effect on water resilience capacities (both in soil and soil substrates) and plant growth through various media of a cellulose-based superabsorbent hydrogel. In comparison with the unamended soil at a wilting point of −15 bar, hydrogel improved soil moisture potential by around 400%. The cultivation trails on cucumber (in soil) and sweet basil have shown a general increase in plant quality and development without phytotoxicity.

IX. HYDROGEL

It is a 3-dimensional molecular network of hydrophilic cross-linking polymers which can absorb massive amounts of water and hold it (Klouda et al., 2008; N. Peppas et al., 2000; Peppas et al.,2006). Potassium polyacrylate or sodium polyacrylate is a popular ingredient in agricultural hydrogels. It can absorb a lot of water and transform it into a gel to store it because it's a superabsorbent material (Tomczykowa et al., 2019). Hydrogel use expands the water holding properties of various soils, such as clay and sand processes, through the use of gel-producing polymers. This will result in a significant increase in water storage and usage (up to 85 percent) (Hennink et al., 2012; Peppas et al., 2000). Polymer improve soil permeability, decrease irrigation requirements, minimize compaction, soil erosion, and leaching, and boost plant growth (Lin et al., 2006; Nguyen et al., 2002). Many arid and semi-arid areas of the world face desertification and water shortages, which can be mitigated with hydrogels.

X. TYPE OF HYDROGELS.

There are two broad groups of hydrogels: soluble (linear) and insoluble (PAM) (crossed linked). Linear PAM is dissolved in water and used in agricultural fields effectively to reduce irrigation caused erosion (Caliari et al., 2016). Cross-connected PAM does not melt but forms a gel by adding water and is frequently used as a means to preserve humidity in agriculture, in landscapes and in nurseries (Omidian et al., 2005).

XI. SUPERABSORBENT POLYMER HYDROGELS AS SOIL CONDITIONERS

Erickson owns a patent for a program to improve water conservation and the strength of soil matrixes by injecting polymeric films with areas of water infiltration into the soil (Cannazza et al., 2014). The invention of this film introduced alternatives to the prior use of directly added soil absorption powder that can cause remarkable problems when particles move soil maintenance locations causing soil sealing effects. The absorbing polymer may be bent, crushed or chopped and inserted in the soil to discourage screening and to increase the water retention ability by putting it into the film format. As super absorbing polymers used in Sudan on drought-affected soles (Mudiyanselage et al., 2008). Poly (vinyl alcohol) has that the field potential of soil has increased by 22% and that all polymers have increased. In addition to polyacrylamide and poly (vinyl alcohol), tested the production of the barley and salad into coarse soil with a starch copolymer (Cipriano et al., (2014). Their findings were that the longer the time before plants reached their wild point was increased by the percentage of SAPs for water retention (Su et al., (2019). The biodegradability degree was determined based on mineralization of polymers, calculated by CO_2 emissions from biodegradation reactions. The added polymers couldn't biodegrade micro-organisms naturally present on the earth. That is why their study was carried out in order to explore possible microbes to increase the biodegradability rate (Chaithra and Sridhara (2018)).

Research has been carried out over the past few years to explore various forms of polymer composites which would improve the efficacy of saps in soil conditions. In mild and poor irrigation conditions granular polyacrylamide can be used. It has been show that with mild dry exposure, the presence of SAPs improved irrigation effectiveness at 8.1%. Moreover, they observed a decrease of the activity of antioxidant enzymes allowing oxygen radicals to damage the plant's carbon fastening ability and subsequently its development could be caused by the presence of granular polyacrylamide (Kiatkamjornwong, 2007).Thus plant growth was adequate under lower irrigation conditions, even under the influence of polyacrylamide SAPs described the polymers synthesis (aspartic acid), the high biodegradation potential of which is characteristic of interest. In addition, they propose to improve the synthetic route by including or charged biochemical linkers. None of these synthetic pathways, however, produced a completely biodegradable substance. The cellulose-based SAPs are in essence, an environmentally sustainable alternative to acrylate-based saps (Zhu etal., 2015). The derivatives used for the synthesis of the cellulose-based hydrogels were carboxymethyl cellulose sodium and hydromethyl cellulose cellulose, respectively. The quality of the swelling, water preservation and soil conditioning of the acrylate-specific SAPs was shown very similar after testing. Dragan identified studies of bio polymeric materials in interpenetrating polymer networks (ipns). Dragan identified use of the IPN in aqueous solution After incorporating cellulose derivatives in the polymer network, the sorption potential of the substance improved dramatically. SAPs may also be used for gradual release of fertilizer in the soil, in addition to soil conditioning (Amjad and Reddy, 2002)). On esterification, a SAP synthesis mixing polyvinyl alcohol groups with phosphoric acid (H_3PO_4) was not only able to contain and hold water, but was also able to release the fertilizer of phosphates. However, the analysis only checked the capacity for swelling and release characteristics in an aqueous environment, not soil, which revealed 79% of the substance releases in 28 days. Via differing concentration gradient within or outside of the material, the dissolved phosphate groups diffused out of the hydrogel. On the other hand it also tested NPK's entry into the poly (superabsorbent composite)/kaolin clay, measured by CO_2 emissions emitted by the reaction of biodegradation. Increasing the expense and swelling capability of the substance were the addition to the silicone polymer by clay. Tested swelling potential and mechanism in the aqueous medium during the work mentioned (Álvarez-Chávez et al., 2012). They developed a temperature-based release process, which indicated that the greater the nutrient's solubility and the quicker its release as temperatures rise. Decrease production costs, environmental concerns arising from the addition of non-biodegradable soil materials remain to be overcome. In this respect, researchers concentrate on identifying products that are environmentally sustainable and that satisfy the economic needs of human beings without growing waste accumulation. Jaewpirom and Jamnongkan had mentioned three hydrogels and chitosan alcohol. The swelling capabilities of the three soil materials were checked. The pure chitosan hydrogel was most promising for the release potential of potassium in the soil. At this point the reader will understand the importance of advancing the use of hydrogetics in agriculture and the exploration and synthesis of soil friendly environmental substances such as biopolymers. While the importance of sustaining incredible swelling capacities with mixed fertilizer releases remains to be a variety of obstacles, the new age of chemical discovery led by the ideals of green chemistry will lead to new findings in this constant field of materials and agricultural science.

XII. SUPERABSORBENT POLYMER HYDROGELS

SAP is characterised as a loosely cross-linked 3D polymer network, consisting of ionic monomers whose importance is the capability of swelling (Rehman (2019). The density of the crosslinking chain produces an articulate free volume between polymers, which can in turn accumulate and retain large amounts of water between 10 and 1000 g/g, together with a large number of hydrophilic groups (1.000-100.000 percent). A multi-stage process explains the retention and swelling potential of a SAP. First step involves moisturising hydrophilic groups with tight bonds to water in the polymer network. The relationship with water and exposed hydrophobic groups makes secondary weaker bonds with water (Zhu et al., (2015)). The next step is to mitigate the influence of osmotic forces, which would dilute the polymer network indefinitely, and the network thus absorbs additional water (Jensen, 2013). SAPs are categorised primarily by roots, cross-link design and responsiveness function. SAP is natural, synthetic or a mixture based on its nature. In terms of the interlinking mechanism, a SAP is chemically interlinked, which establishes covalent relations with the polymer networks, leading to a stable or physical interlink in which polymer network, hydrogen bonding and van der wall forces are interlinked. An SAP reacts to a standard pathway or is triggered by an external stimulus. Under the environmental stimuli, a typical SAP would not have improved the swelling balance. A smart or smart hydrogel, since the swelling balance for these materials can be tailored to climate. Reversible swelling/dewelling applications can be modulated on the basis of chemical rely on various environmental conditions such as high ionic performance (Kiatkamjornwong (2007).

XIII. MIXED HYDROGELS OR HYBRID POLYMERS

Several companies have used consumable polysaccharide hydrogels. The hydrogels that contain single polymers are therefore not adequate to achieve the properties and performance necessary (Kyrikou and Briassoulis, 2007). Therefore, mixed polysaccharides are based to improve different characteristics. The sodium alginate hybrid hydrogel (CMC) and carboxymethyl chitosan (CMC) have been prepared by the introduction of OSA (sodium alginate oxidation), which is accompanied by a connection to the carboxymethyl chitosan amino band. Approximately 6.3 s is found to have minimum gelation with 8 mL of OSA. Indicating a higher cross-linking degree with increasing the sum of OSA. In another study, the CMC biocompatibility and the OSA-based injecting hydrogel as carrier of neural stem cells have established. These hydrogels have shown their capacity to self-heal under physiological conditions. Furthermore, the stiffness of the hydrogel is identical to normal brain tissues that promote the proliferation inside the 3D hydrogel of neural loaded stem cells. This kind of hybrid polysaccharide-based hydrogels would also open doors to hydrogels for the application of neural stem cells (Guilherme et al., (2015). Dextran and gelatine have been modified by oxidation and amination to provide a quick-forming gel substance without using an external crosslinker. Dextran was modified with dialdehyde periodate and ethylenediamine gelatine. The hydrogel was assessed for its promise in the field of cartilage technology. Synovium-based mesenchymal cell technology application subcutaneously, TGF-3 (growth factor) was injected into the athymic nude mice's dorsum. The biocompatible hydrogel is thus useful in a number of applications, such as hydrogels based on synthetic polymers have been restricted by toxicity. As a result, such a nontoxic, biocompatible hydrogel may be useful in a variety of applications where synthetic polymer-based hydrogels are restricted by toxicity concerns.

XIV. HYDROGEL-BASED EDIBLE POLYMER PROPERTIES

The essential properties that the hydrogel should possess or that one must determine after it has been established. Applicability is determined by the degree of swelling and mechanical properties, as well as toxicity and biocompatibility a fantastic idea. These features in fact help to dynamically regulate the expansion and contraction of hydrogels to stimulate intelligent materials. Scientists aim to imitate the biological function of the human organs (muscles, bone, the permeable membrane, cartilage, etc.), while utilizing intelligent hydrogels to maintain certain properties in attention. Examples of these include magnetic reactive actuators, artificial electrically driven muscles, temperature-controlled form memory hydrogels, and the very common distribution systems. There is also a finding that the flexibility of these hydrogels is very close to natural tissue.

XV. AGRICULTURE APPLICATION OF BIODEGRADABLE POLYMERS AND FUTURE ASPECT

Organic chemicals are categorized in an atmosphere as biodegrading, in which the compounds are mostly mineralized and redistributed by biomass, nitrogen and Sulphur cycles to the micro-organisms (Sayyari et al., 2012). The solution to some environmental issues of the use of polymers in agriculture remains a prerequisite for natural and/or biodegradable polymers (Stahl et al., 2000). As shown above, synthetic polymers are used most frequently, either in smart agrochemicals or super absorbents which severely produce large amounts of non-biodegradable wastes and soil pollution. Polymer biodegradation is a new and very extensive field of study. However, literature also begins the relationship between the agricultural use of polymers in the soil (Vickers, 2017). There have been many papers on the soil and aqueous polymers decomposition process. However, there has been little debate about the polymer degradation of agrochemicals embedded in a polymer matrix (Yang et al., 2014). Furthermore, it is difficult to classify a polymer in the mild agricultural areas both for long-term accurate release control and for high biodegradation rates. The effect of Tg on polycaprolactone polyurethane urea release and biodegradation has been studied. According to the scientific researchers, biodegradation affected the temperature of the glass transition and the recrystallisation of the polyurethane membrane (Mitrus et al., (2009). Use decaying polyurethane as ammonium sulphate fertilizer for cover and final biodegradation testing. Biodegradation investigations on superabsorbent polymers were also conducted (Harshvardhan and Jha, 2013). Prepared on a silicate /acryl-based polymer the degradable superabsorbent substance. They suggested a technique of Si-O-C hydrolysis in water solution that in a few of days destroyed hybrid hydrogels. Detailed data indicate that, if anything at a rate of 0.12-0.24 percent for 6 months, the major polyacrylic chain deteriorated in soils (Shaviv, 2001). The biodegradability rate of the polyacrylamide and polyacrylate superabsorbent copolymers in soils has been examined. The level of biodegradability based on mineral polymers, measured by environmental modification processes, was tested. Previously proven, the additional polymers could not be biodegraded by microorganisms that naturally occur in the soil (Degraeve and Galland, 2010)).

XVI. REGULATED RELEASE ADVANTAGE AND DISADVANTAGES.

The benefits of regulated releases include the day to day and ongoing supply of plant nutrients, decreased soil frequency, minimised liquid nutrient degradation, volatilization and immobility, root damage avoidance attributable to a high level of sales, improved satisfactions in fertiliser handling and a contribution to the removal of NO3 (Evon et al (2021). Despite increasing developments and advantages in controlled release products, their use in relation to traditional agrochemicals is much more regulated because of their high manufacturing costs There are other drawbacks that must be addressed, such as the early and fast release of the nutrients (spring effect), which may destroy the plant or result in non-release during times of high crop demand (Wool and Sun, 2011)). During the material production process another drawback of use managed releases could arise because the effect of nutrients on the land is difficult to quantify. Several models and experiments in order to model the release process have widely been investigated. The process for regulated releases of agrochemicals is well known to be governed by the diffusion coefficients and coating thickness under Fick's F (Sutradhar et al., 2015)). irst Diffusion Law. In other terms, the rate of solution diffusion of the substance and the water/vapo rate are related. Since 1979, Jarrell and Boersma have modelled urea distribution from sulfur-encapsulated particles under soil conditions, numerous experiments about the mathematical models have been performed for controlled release. Their fabrics were brittle and polymer-preserved. However, the polymeric content has degraded the soil conditions and microorganisms of the environment, revealing the more fragile layers. Nevertheless, temperature and soil water content is influenced by the nutrient propagation of pores. The release mechanism is often separated in three periods as defined in the previous study. First, is the lag time or first step, at which nearly no release can be detected. The second cycle takes place until a continuous release is reached and the third period occurs when there has been a steady decay or release. However, while there are drawbacks relative to traditional methods for the evaluation of release profiles listed above, managed release materials promise to improve farm management.

XVII. CONCLUSION

Agricultural productivity can be enhanced using polymers. In agriculture, polymers play an important role in providing an atmosphere that favour plant growth, while developing polymers from greenhouses that allow plants to prevent overheating that is unhealthy for plants, irrigation polymers, fumigation polymers and polymers.

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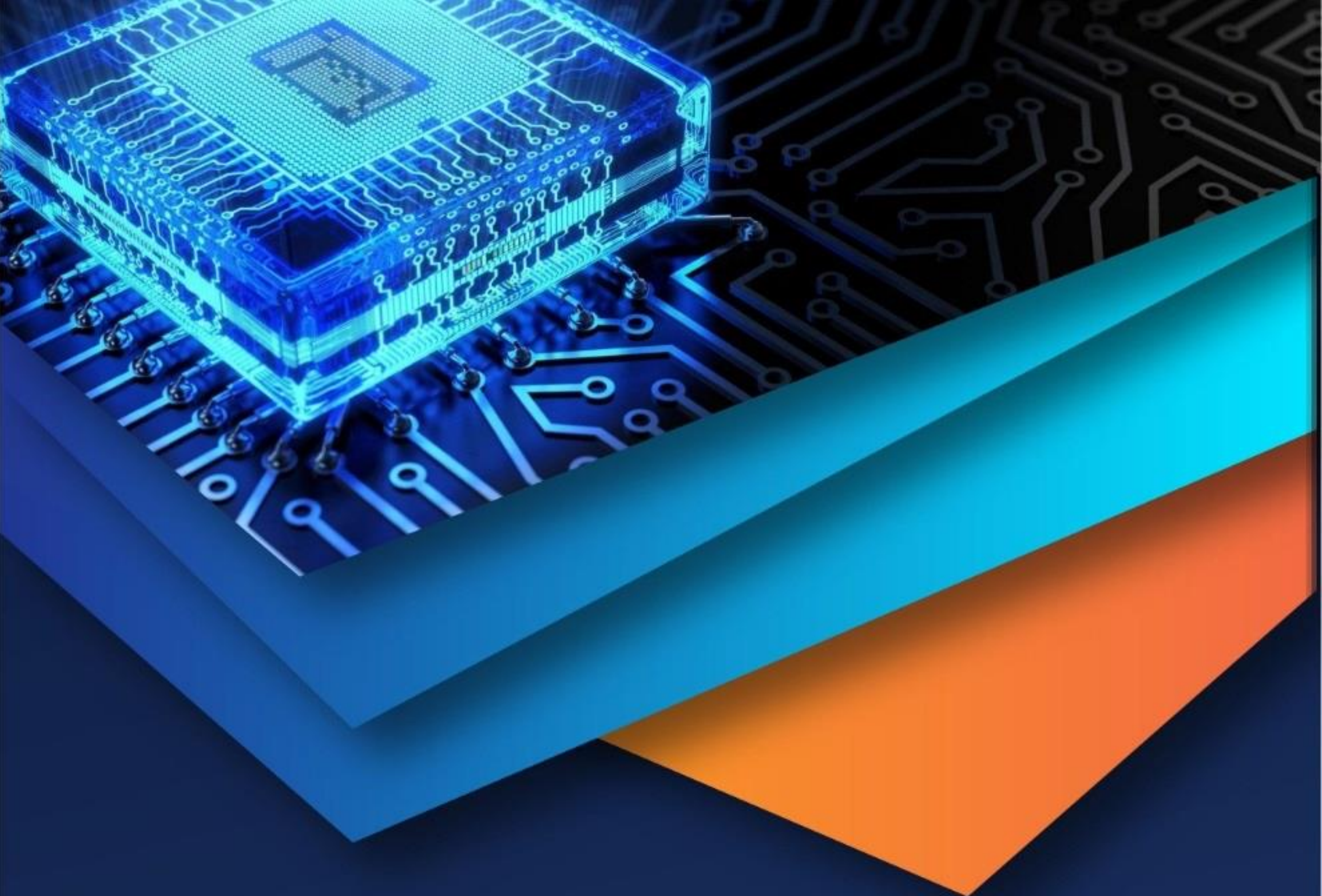

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