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Rice Straw on Apparent Density of Foam Concrete

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Abstract: Foamed concrete is a material with great development potential, which has been used in the construction industry. But foam concrete still has some shortcomings. The purpose of this article is to study the effect of rice straw on the apparent density of foam concrete. Through literature research and investigation, the preparation process, raw material composition and application fields of foam concrete are briefly introduced, and the characteristics of foam concrete are analyzed, including lightness, permeability, corrosion resistance, thermal insulation and so on. Through experimental methods and data analysis, the effect of rice straw on foam concrete was studied, including the length, diameter and content of rice straw. The results of the study show that, without the admixture, the length of the rice straw is 3 mm, directly 1 mm, and the content is 2%. The apparent density of the foam concrete is at least 449 kg / m3. When an additive is added to the foam concrete, and the foam stabilizer content is 0.02%, the water reducing agent content is 0.3%, and the accelerator content is 3%, the rice straw length is 5mm, directly 1mm, the content is 1 %, The apparent density of foam concrete is at least 426kg / m3. There are many factors to evaluate the performance of foam concrete. This article only considers the effect on the apparent density, but in practical applications, it is necessary to determine its performance in all aspects, especially in terms of strength.

1. Introduction

Foam concrete is a kind of porous lightweight concrete prepared by cement, appropriate mineral admixture, appropriate admixture, foaming agent and foam stabilizing material according to a certain mixture ratio and a certain preparation process. It is combined with foam glass, foam ceramics and foam aluminum and is called four inorganic foam materials. It will make heavy cement concrete light and functional, endowing it with dozens of functions such as light weight, heat preservation, heat insulation, sound absorption, sound insulation, fire resistance, impermeability, waterproof, shock wave resistance, electromagnetic wave resistance, water permeability, air permeability, filtration, corrosion resistance, water retention, energy absorption,

etc. Foamed concrete is often used on thermal insulation buildings such as buildings and pipelines, and it is also involved in applications such as sound insulation.

At present, Chinese researchers are studying its mechanical properties or thermal properties. However, most researchers pay little attention to its durability and permeability. Therefore, it is necessary to make the research on all aspects of performance systematic so as to make the research completer and more relevant. The systematic theory will be helpful to the development and application of materials [1]. Most of the researches in the world exist at the macro level, and the microscopic researches on materials are relatively rare. The study of microstructure is mainly focused on bubble voids, which have great influence on materials. The microscopic study of foam concrete, especially the study of bubble voids, will be of great help to the performance analysis and the establishment of the model [2]. Foamed concrete is still less used in China and has some applications in the construction industry at present. However, China has not yet formed a system for the production and research of this material. All kinds of research and production are relatively independent and scattered, which is not conducive to the development of foam concrete [3]. It is necessary to formulate relevant rules and standards. At present, China's production is mainly manual batching and manual electric control operation, which are not efficient and accurate enough for mass production, and the product quality is unstable [4]. In this regard, China should increase investment and gradually narrow the gap with developed countries.

MU tested the compression, bending stress and strain of samples with different fiber addition methods through orthogonal test design. Tests show that fiber content is the most important factor of bending stress. The next is fiber type, and the third is fiber mixing ability. Fiber type is the most important factor affecting stress curve. Fiber is not conducive to compressive strength, but is conducive to flexural strength [5]. In order to explore new building materials, Matej tried to replace cement mixture with cement foam concrete Poroflow17-5. Based on the results of the static load test using the test experimental equipment, the modulus range for estimating Poroflow17-5 is calculated afterwards [6]. Ailar believes that the properties of foam have a great influence on the performance of foam concrete before the lightweight structure solidifies and maintains its shape. Xanthan gum (with thickening ability) was used to aggregate the liquid film. The prepared foam was significantly more stable than the control foam, and the mechanical properties of the final pore structure were significantly improved [7]. Choi in order to understand the performance of foaming agent and determine the influence of foam on cement mixture. By setting water-binder ratio, type and concentration of foaming agent as influencing factors, the volume test, bubble shape analysis, compressive strength test, apparent density and air percentage content of foaming agent were determined [8]. Yu studied the thermal properties of steel slag fly ash foam concrete through experiments and analyzed the results. It is found that the general model can better predict the thermal conductivity of foam concrete. For the same density, the thermal conductivity increases and the specific heat decreases with the increase of steel slag. Porosity is linearly related to density of foam concrete [9].

At present, the influence of substances studied on foamed concrete is mostly only studied on foamed concrete with or without admixtures. The innovation of this paper lies in the fact that the foam concrete without admixture and with admixture are studied at the same time, and it is found that the influence of straw size and content on the two kinds of concrete is not exactly the same. This will enlighten the research on the influencing factors of foam concrete.

2. Preparation and Application of Foam Concrete

2.1. Preparation Process

Foamed concrete actually belongs to a kind of material containing bubbles and has certain

thermal insulation performance. There are many bubbles in foamed concrete. These bubbles are sealed by concrete. The bubbles increase the volume of concrete, thus reducing the density of concrete. The concrete preparation process of the foundation is shown in Figure 1.

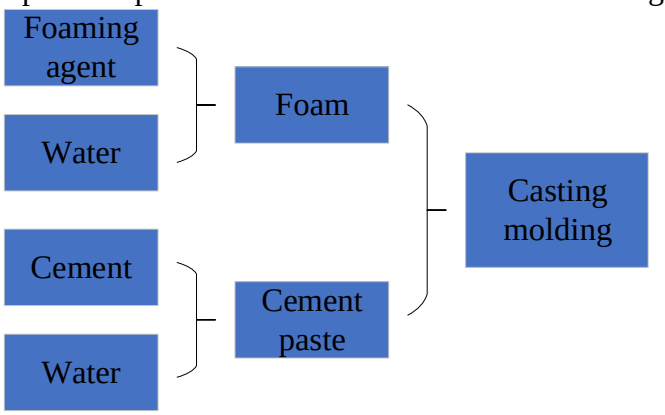

Figure 1. Concrete preparation process of foundation

The simplest concrete preparation method is the same as that shown in the above figure. In general, bubble machine will be used for foaming, because mechanical foaming has higher efficiency and is more sufficient to generate more bubbles. After that, the foam and cement slurry should be mixed and fully stirred. For the preparation of a large amount of foam concrete, mechanical stirring must be adopted to uniformly stir. Generally, after the stirring is completed, the product after the stirring is transferred to the model by a pump. After casting and molding, curing is often required for a period of time. Different formulations, raw materials and manufacturing methods require different curing times. Some foam concrete has a long curing time, even more than 20 days.

2.2. Raw Material Composition

Foam concrete is generally composed of cement, cement foaming agent, aggregate, fly ash, admixture and water. However, its composition is not so rigid and fixed. In many cases, it can be changed according to the target requirements and some other things can be added, such as chopped fibers and organic polymer [10]. Rice straw was added in this experiment. These additives will have certain effects on the properties of foam concrete, which often include density and strength.

Cement: also called cementing material. Cementitious materials are added to foam concrete to play the role of bonding. Without cementitious materials, foam concrete is impossible. The highest content of foam concrete is cement, more than 90% of the substances are cement, so cement is the most important thing in foam concrete and has the greatest impact on it. The influence of cement is mainly reflected in the type and dosage. Under normal circumstances, the amount of cement is constantly increasing, then the strength of foam concrete will show a trend of increasing first and then decreasing, that is to say, there will be an optimal value of cement amount in the middle [11]. This optimal value is often not fixed, because factors such as apparent density should also be considered. The best value needs to be determined according to actual needs. However, there are also special circumstances, that is, in the clean slurry system. In this system, the amount of cement can have a relatively small impact, so the amount is often the same. In this case, the type of cement that still has a great impact is the type of cement, which determines the strength of the cement itself, and also determines the strength of foam concrete. At present, among the widely used cements, silicate series cements are generally better in effect [12]. Its quality is relatively high, and the product quality is not easy to be uneven. In addition, its numerous sources and large output also

lead to lower prices. The characteristic of low price can effectively reduce the phenomenon of shoddy fraud.

Cement foaming agent: there are many things that can generate bubbles in both life and industrial production, but most of them cannot become cement foaming agent. Cement foaming agent has strict requirements. First of all, it must be stable enough. This stability is manifested in many aspects. First, it is stable in its own nature and is not easy to react with the outside world. Cement foaming agent is often transported to the construction site, where there are usually no good storage conditions. If the nature of the substance itself is not stable enough, it is easy to fail. Secondly, the generated bubbles are stable enough. If the bubbles dissipate as they are generated, the effect will be greatly weakened. In addition to stable properties, care should also be taken not to crack the mud after mixing with the mud, otherwise the material will be broken before construction and the strength cannot be guaranteed at all. In addition, foaming agent cannot affect the coagulation and hardening of cementitious materials. Cement foaming agent is an important influencing factor in the preparation of foamed concrete. Whether the density of the slurry or the apparent density can be realized by changing the content of the cement foaming agent. Different varieties and contents of cement foaming agent will also have certain influence on the strength of foamed concrete. Therefore, in order to obtain high-quality foam concrete suitable for the target demand, we must first find the most suitable foaming agent types and determine their proportion and content.

Aggregate: The preparation of foam concrete aggregate is generally divided into three categories: ordinary aggregate, lightweight aggregate and ultra-light aggregate. According to the density and strength requirements of foam concrete, decide whether to use aggregate and which aggregate to use. The aggregate type and apparent density have obvious influence on the strength of foamed concrete. In order to ensure the density of foam concrete, lightweight aggregate can be used to make the structure formed by cement slurry denser than that formed by ordinary aggregate. The compressive strength of foam concrete is usually low, and the compressive failure usually occurs in cement-based matrix containing a large number of pores. Compared with ordinary concrete, the use of low-density aggregate will significantly improve the compressive strength of foam cement.

Admixtures: include foam stabilizer, coagulant, water reducer, etc. The function of foam stabilizer is to stabilize foam, so that foam can maintain long-term performance and increase the existence time of foam. Coagulant is generally used to adjust the setting time of foam concrete. Water reducing agent is generally used to prevent foam concrete from settling and cracking after hardening.

Other: In order to improve the shear resistance of foam concrete, some short fiber materials such as polypropylene fiber, alkali-resistant glass fiber, polyvinyl alcohol fiber and other materials can be added to the mixture. The fiber plays an anti-cracking role in the matrix and improves the deformation resistance of foam concrete.

2.3. Foam Concrete

In recent years, China has paid more and more attention to building energy conservation. With the implementation of building energy-saving policies, the reform of building materials has achieved remarkable results, and energy-saving materials are becoming more and more popular. Foam concrete has been applied to energy-saving building materials due to its good characteristics and has been applied in other fields. At present, the application of foam concrete in China is as follows.

(1) Foam concrete block

Foam concrete block is the most widely used material of foam concrete in building materials. In

southern China, foam concrete blocks are often used as infilled walls of frame structures, mainly because of their good thermal insulation performance and light weight and high strength. Harbin Architecture University has developed polystyrene foam concrete blocks and used them in urban construction. The building block is made of polystyrene foam plastic as aggregate, cement and fly ash as cementing materials, and a small number of additives through stirring, molding and natural curing. It can be used as non-load-bearing wall material for internal and external walls, as well as roof insulation material.

(2) Foam concrete light wallboard

At present, the main material of building partition wall and partition wall is GRC light wallboard, which is affected by the high price of raw materials, thus affecting its popularization and application. Using GRC partition board production technology and combining the research results of solid foaming agent and foam cement, the China Academy of Building Materials Science has developed the production technology of fly ash foam cement lightweight wall board and has been applied.

(3) Foam concrete compensation foundation

Modern architectural design and construction pay more and more attention to the free settlement of buildings during construction. Due to the different deadweight of each part of the building group, the free settlement during construction will also be different. In the process of architectural design, it is required that the building foundation with low self-weight should be filled with soft materials as compensation foundation. Foam concrete can better meet the requirements of compensation foundation materials.

(4) Retaining wall

It is mainly used as the rock wall of the harbor. Foam concrete, as a light backfilling material, can reduce vertical load and lateral load of bank wall. This is because foam concrete is a rigid body with good bonding performance. It will not exert lateral pressure on the surrounding bank wall. The settlement is reduced, the maintenance cost is reduced, and a large amount of expenses are saved. Foam concrete can also be used to improve the stability of embankment slope. Using it to replace part of the soil on the slope can reduce the force that affects the stability of the slope due to the decrease in mass.

3. Characteristics of Foam Concrete

3.1. Characteristics of Foam Concrete

(1) Light weight

Foam concrete has low density, and its density grade is generally 300-1800 kg/m3. The density grade of commonly used foam concrete is 300-1200 kg/m3. In recent years, ultra-light foam concrete with a density of 160 kg/m3 has also been applied in construction projects. Due to the low density of foam concrete, the use of this material in the internal and external walls, floors, floors, columns and other building structures of buildings can generally reduce the dead weight of buildings by about 25%, and some can reach 30%-40% of the total weight of structures. In addition, for structural members, if foam concrete is used instead of ordinary concrete, the bearing capacity of the members can be improved. Therefore, the use of foam concrete in construction projects has significant economic benefits.

(2) Permeability

The water absorption rate of foam concrete decreases with the decrease of density, because the volume of low-density concrete slurry is small, so the number of capillary pores is small. The water absorption rate of foam concrete is mainly affected by cement paste. Bubbles introduced by foaming agent are mainly closed channels and do not participate in water absorption. Ordinary concrete usually uses water absorption rate and mass percentage of concrete to measure water

absorption rate, while foam concrete has lower density. For example, water absorption capacity is expressed as a mass percentage. This value is too large to be misunderstood. Expressed as the amount of water absorbed per unit volume of concrete.

(3) Erosion resistance

The corrosion resistance of foam concrete includes frost resistance, sulfate resistance, carbonation resistance and chloride ion resistance. Jones and Cathy studied the properties of foamed concrete after 12 months of sulfate attack. the results show that foamed concrete has good chemical corrosion resistance. In addition, their research shows that low volume density foam concrete has faster carbonization speed. Compared with cement sand foam concrete and cement fly ash foam concrete, cement fly ash foam concrete has faster carbonization speed. Accelerated chloride ion erosion test shows that foamed concrete has the same resistance to chloride ion erosion as ordinary concrete.

(4) Thermal insulation

Foam concrete has excellent thermal insulation performance due to its special pore structure. The thermal conductivity of foam concrete with volume density of 1000 kg/m3 is about one sixth of that of ordinary mortar. For foam concrete with dry bulk density of 600-1600 kg/m3, its thermal conductivity is in the range of 0.1-0.7 w/m k, which is 5%-30% of ordinary concrete. The thermal conductivity decreases with the decrease of volume density. Therefore, using foam concrete as wall material can exert good thermal insulation performance. The thermal conductivity of foam concrete is approximately inversely proportional to its bulk density. The higher the bulk density, the lower the thermal conductivity. Clean mortar or the ratio of mortar to foam directly affects the volume density of foam concrete, thus affecting its thermal insulation performance.

3.2. Market Value

Facing the increasingly competitive market environment, how to obtain more economic benefits for construction enterprises has become the focus of competition. As a new type of building material, foam concrete's advantages also determine its own application value. From the current practical application, the value of foam concrete is as follows.

(1) Reduce self-weight

Modern architectural design concept advocates the concept of "light weight and light consumption", aiming at continuously reducing the weight of buildings. The use of lightweight concrete materials can avoid concrete subsidence and cracks caused by excessive foundation pressure and ensure the extension of the service life of the materials.

(2) Reduce costs

Due to the integration of advanced science and technology in the preparation of new concrete materials, the production cost of the materials will also be greatly reduced. From the point of view of construction project, it directly and effectively controls the construction cost of the project and prevents the construction cost from being too large and affecting the economic benefits of the construction unit.

(3) Fire prevention

At present, building fires have become the biggest "threat" affecting the use of buildings. Due to improper use of materials, many buildings have increased the incidence of fire. The use of foam concrete lightweight materials can play a triple role of "sound insulation, heat insulation and heat preservation". In order to avoid the occurrence of fire.

(4) Environmental protection and energy conservation

Facing the increasingly polluted social and natural environment, new concrete materials are used in construction. This can achieve the effect of "saving energy and reducing consumption" on the

premise of ensuring the quality of the building, enabling the whole building to be used for a long time and playing a good role in environmental protection.

3.3. Existing Problem

(1) The strength is not high

The foam concrete developed at this stage has a bulk density of almost 300 to 1000 kg/m3 and a compressive strength of only 0.6 to 8 MPa. Compared with traditional concrete, the compressive strength is too low, which limits the application range of foam concrete. Foam concrete is of great significance. At the same volume density, the strength of foam concrete mainly depends on the strength of cement matrix and pore structure. The higher the strength of cement matrix, the smaller the pore size of foam concrete, the more uniform the pore distribution, and the higher the strength of foam concrete. Using magnesium oxychloride cement and ordinary Portland cement as basic materials to prepare foamed concrete with a volume density of about 500 kg/m3, it is not difficult to find that the strength of magnesium oxychloride cement foamed concrete is significantly higher than that of ordinary Portland cement foamed concrete. Therefore, we can try to improve the strength properties by adjusting the raw materials and formula.

(2) Poor integrity

Foam concrete has poor integrity and shrinkage. In order to solve this problem, the common method is to add chopped fibers to foam concrete, but the effect of shrinkage is still not obvious. If the foam concrete shrinks before use after completion, the adverse effects of shrinkage on construction can be well avoided. The solution that can be considered is to add early strength components in the process of preparing foam concrete, so that the cement material can be hydrated in the early stage, while the foam concrete can realize no shrinkage or little shrinkage in the later stage.

4. Experimental Setup and Results

4.1. Experimental Content

The purpose of this paper is to study the effect of rice straw on the apparent density of foam concrete. In foam concrete, the changes of rice straw mainly reflect on the length, diameter and content of straw. First of all, we carried out experiments on the length of straw. The grouping situation is shown in Table 1.

Table 1. Experimental grouping of straw length

Group	Straw length (mm)	Straw diameter (mm)	Straw content (%)	Admixture
A	1	1	1	No
B	3	1	1	No
C	5	1	1	No
D	7	1	1	No
E	1	1	1	Yes
F	3	1	1	Yes
G	5	1	1	Yes
H	7	1	1	Yes

When the length experiment was set, the diameter of straw in all groups was 1mm and the straw content was 1%. The length is 1mm, 3mm, 5mm and 7mm respectively. Besides length, the difference between admixtures is also set. Admixtures are not added to the four groups A, B, C and D, while admixtures are added to the four groups E, F, G and H. We must determine the content of admixture before we carry out the experiment. To this end, we first make basic foam concrete.

The production of basic foam concrete mainly uses water, cement and foaming agent. Firstly, cement and water are mixed and stirred evenly according to the proportion recommended by merchants to obtain cement slurry. Then the foaming agent is mixed with water and stirred for 3 minutes to obtain foam. Then, foam and cement slurry are mixed evenly and cast to form foam concrete. According to the recommended content, the ratio of water to material in the manufacturing process is 1: 2.5, the content of foaming agent is 0.7%, and the dilution ratio is 35 times. The apparent dry density of the obtained coagulation is 600kg/m3, and the compressive strength is 1.65MPa.

4.2. Experimental Results

Admixtures are mainly divided into foam stabilizing agent, water reducing agent and coagulant. Its function has already been mentioned above, and a good addition ratio should be determined here. For this reason, we have carried out an experimental study on the additive content one by one. The first is foam stabilizer. The results are shown in Table 2.

Table 2. Experimental results of foam stabilizer content

Content (%)	Apparent density (kg/m^3)	Compressive strength (MPa)
0.01	630	1.59
0.02	560	1.71
0.03	548	1.62
0.04	521	1.53

From the data in the table, we can find that the apparent density has a twist and turns process with the change of foam stabilizer content. When the content is 0.01%, the apparent density increases, the compressive strength decreases, and the material properties deteriorate. During the process from 0.02% to 0.04%, the apparent density of foam concrete has been decreasing, but the compressive density is also decreasing greatly, and the decreasing speed is faster than the apparent density. Therefore, in order to ensure the performance of the material, we selected 0.02% foam stabilizer content. Then, the water reducing agent content was tested, and the obtained results are shown in Table 3.

Table 3. Experimental results of water reducing agent content

Content (%)	Apparent density (kg/m^3)	Compressive strength (MPa)
0.1	518	1.49
0.2	572	1.88
0.3	535	2.16
0.4	546	1.74

From the data in the table, we can find that the apparent density fluctuates in waves with the change of water reducing agent content, but the apparent density of all groups added with water reducing agent is smaller than that without water reducing agent. When the content is 0.1%, the apparent density is the smallest, but the compressive strength is also low, and the material strength is poor. During the process from 0.2% to 0.4%, the apparent density of foam concrete first decreases and then increases, and the compressive density also decreases and then increases. When the water reducing agent content is 0.3%, the apparent density value is smaller and the compressive strength is larger, so the selected water reducing agent content is 0.3%. Then, the content of coagulant was tested, and the results are shown in Table 4.

From the data in the table, we can find that the apparent density increases first, then decreases and then increases with the increase of coagulant content. When the content of coagulant is 3%, the apparent density is smaller and the compressive strength is larger. However, the apparent density of

other contents is greater than that when the content is 3%, and the compressive strength is also less than that when the content is 3%. Therefore, the content of coagulant selected is 3%. According to the above research, the content of foam stabilizer is 0.02%, the content of water reducer is 0.3%, and the content of coagulant is 3%. The apparent density is 480 kg/m3 and the compressive strength is 2.32 MPa.

Table 4. Experimental results of coagulant content

Content (%)	Apparent density (kg/m^3)	Compressive strength (MPa)
1	632	1.76
2	580	1.47
3	526	2.25
4	553	1.69

5. Discussion and Analysis of Experimental Results

5.1. Analysis on the Influence of Straw Size

First of all, we make the waste rice straw into the corresponding size, mix it into cement slurry, add foam, and obtain the foam concrete of rice straw after casting and molding. We conducted experiments according to the sizes of each group, and the measured results are shown in Table 5.

Table 5. Experimental results of straw length

Group	Apparent density (kg/m^3)	Group	Apparent density (kg/m^3)
A	532	E	436
B	472	F	407
C	495	G	398
D	543	H	419

In order to compare the effect of straw length on the apparent density of foam concrete, we plot the relevant data into a line chart, as shown in Figure 2.

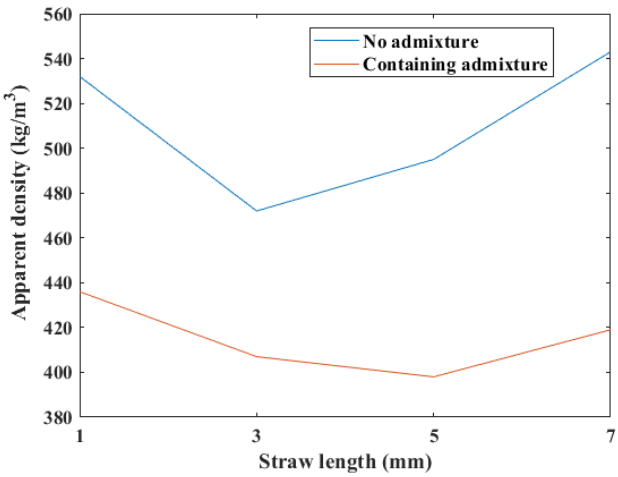

Figure 2. Effect of straw length

From the data in the above figure, it can be seen that the influence of rice straw length on the apparent density of concrete has changed after adding additives. When the length of rice straw is 3mm without additive, the apparent density of foam concrete is the smallest. However, when the length of rice straw is 5mm after adding additives, the apparent density of foam concrete is the smallest. From this, we can infer that the foam concrete has different adaptability to the length of

added rice straw due to some changes in the structure and properties of the foam concrete caused by additives and the changes in this structure. In this experiment, foam concrete with additive is more suitable for 5mm long rice straw, while foam concrete without additive is more suitable for 3mm long rice straw. We designed the experiment according to the length of rice straw to which they were adapted, and studied the influence of rice straw diameter. The experimental results are shown in Table 6.

Table 6. Experimental results of straw diameter

Straw length (mm)	Straw diameter (mm)	Straw content (%)	Admixture	Apparent density (kg/m^3)
3	1	1	No	455
3	2	1	No	468
3	3	1	No	499
3	4	1	No	517
5	1	1	Yes	398
5	2	1	Yes	409
5	3	1	Yes	421
5	4	1	Yes	428

In order to facilitate the experimental exploration, we will draw the data in the chart into a line chart, as shown in Figure 3.

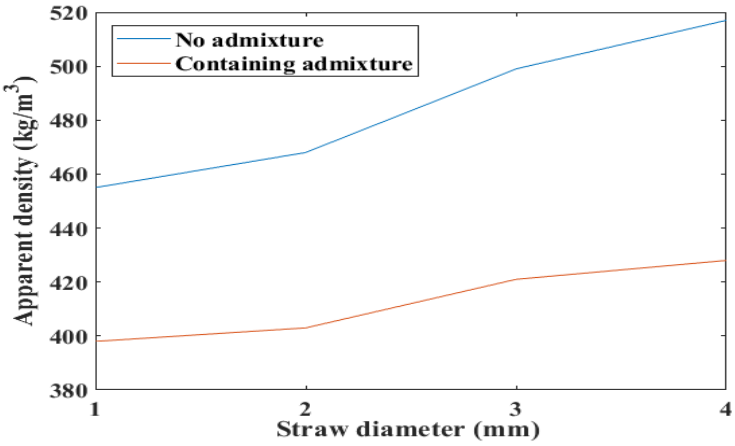

Figure 3. Effect of straw diameter

From the above figure, we can find that although the diameter of rice straw has different influence on the apparent density of foamed concrete with or without additives. However, the overall impact trend is similar. With the increase of the diameter of rice straw, the apparent density of foam concrete shows an upward trend. Therefore, when the diameter of rice straw is 1mm, the apparent density of foam concrete is the smallest.

5.2. Analysis on the Influence of Straw Content

In the above experiment, we discussed the influence of rice straw length and rice straw diameter on the apparent density of foam concrete. Without additive, the most suitable rice straw length is 3mm and the most suitable rice straw diameter is 1 mm. When additives are added, the most suitable length of rice straw is 5mm and the most suitable diameter of rice straw is 1 mm. In the above experiments, the content of rice straw is 1%, we suspect that the content of straw may also have some influence on the density of foam concrete. Therefore, we designed experiments to change the content of rice straw in foamed concrete and measure the corresponding apparent density of foamed concrete. The data results are shown in Table 7.

Table 7. Experimental results of straw content

Straw length (mm)	Straw diameter (mm)	Straw content (%)	Admixture	Apparent density (kg/m^3)
3	1	1	No	455
3	1	2	No	449
3	1	3	No	478
3	1	4	No	493
5	1	1	Yes	398
5	1	2	Yes	406
5	1	3	Yes	417
5	1	4	Yes	426

From the table, we can find that for foam concrete with different additives, the influence of rice straw content is different. For the convenience of discussion, we first plot the influence of rice straw content on foam concrete without additive as a bar graph, as shown in Figure 4.

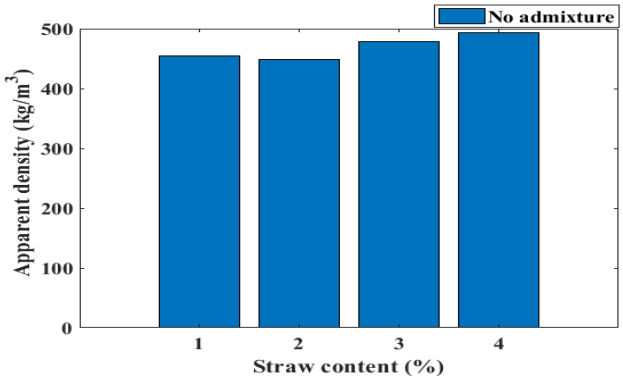

Figure 4. Effect of straw content without additives

From the data in the above figure, it can be seen that the apparent density of foam concrete is 449kg/m3 when the content of rice straw is 2% and 493kg/m3 when the content of rice straw is 4% in the absence of additives, and the apparent density may continue to increase according to the trend in the figure. Next, the influence of rice straw content on foamed concrete with additives is plotted as a bar graph, as shown in Figure 5.

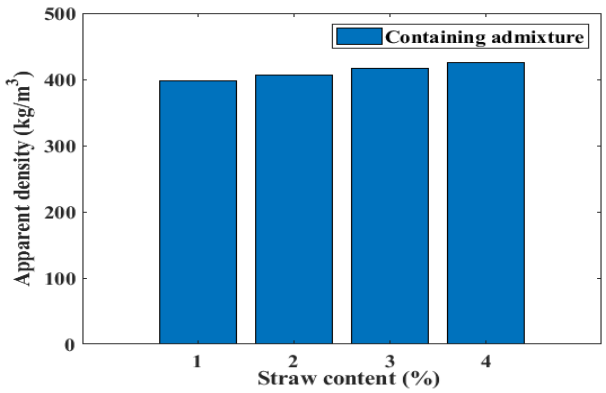

Figure 5. Influence of straw content with additives

From the data in the above figure, it can be seen that the apparent density of foam concrete is 398kg/m3 when the content of rice straw is 1% and 426kg/m3 when the content of rice straw is 4%, and the apparent density may still be increasing according to the trend in the figure.

Through the above experimental analysis, we can conclude that the minimum apparent density of

foamed concrete is 449kg/m3 when the length of rice straw is 3mm, 1mm directly and the content is 2% without additive. When the additive is added to the foam concrete, and the foam stabilizer content is 0.02%, the water reducing agent content is 0.3%, and the coagulant content is 3%, the apparent density of the foam concrete is 426kg/m3 minimum when the length of rice straw is 5mm, 1mm directly, and the content is 1%.

There are still many deficiencies in this experiment. First, the experiments on various factors are not detailed enough. In the experiment of determining additive content, the content span is large and can be subdivided. What's more, it discusses the influence of independent admixtures on foam concrete. In actual situation, when multiple admixtures act at the same time, the effects will inevitably be different, and the optimal content and proportion of various admixtures will also change. Therefore, the additive content determined in this paper is actually a relatively good content and is not really the best content. By the same token, when exploring the influence of rice straw length, diameter and content, our size and content can be further subdivided to obtain more accurate values. In the experiment process, we choose the experiment process is to determine the best length of rice straw, then determine the best diameter of rice straw, and finally determine the best content of rice straw. However, if the experimental sequence is changed and the optimal diameter or content of rice straw is determined first, the results may be different. In addition, there are many factors to judge the performance of foam concrete. In this paper, only the influence on apparent density is considered, but in practical application, all aspects of its performance, especially its strength, should be measured.

6. Conclusion

(1) The preparation process, raw material composition and application field of foam concrete are introduced, and the innovation points of this paper are elaborated. Foam concrete is generally composed of cement, cement foaming agent, aggregate, fly ash, admixture and water. At present, foamed concrete is mainly used for manufacturing foamed concrete blocks, foamed concrete light wall panels, foamed concrete compensation foundations, retaining walls and the like.

(2) Through literature research and experimental investigation, the characteristics of foam concrete are analyzed, including light weight, permeability, erosion resistance, thermal insulation, etc. The market value and existing problems of foam concrete are introduced. The best content of additive was analyzed through experiments. The results of data analysis show that the best content of foam stabilizer is 0.02%, the best content of water reducer is 0.3%, and the best content of coagulant is 3%. The apparent density is 480 kg/m3 and the compressive strength is 2.32 MPa.

(3) Through literature research and data analysis, the influence of rice straw on foam concrete was studied, including the length, diameter and content of rice straw. The results show that the minimum apparent density of foamed concrete is 449kg/m3 when the length of rice straw is 3mm, the length of rice straw is 1mm, and the content of rice straw is 2%. When the additive is added to the foam concrete, and the foam stabilizer content is 0.02%, the water reducing agent content is 0.3%, and the coagulant content is 3%, the apparent density of the foam concrete is 426kg/m3 minimum when the length of rice straw is 5mm, 1mm directly, and the content is 1%.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this

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Conflict of Interest

The author states that this article has no conflict of interest.

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