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Research Article

Research on *In-situ* Disposal Technique of Food Production

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Abstract: Abandoned food production, as which is waste rock associated with the food, occupied large tracts of land and pollute the environment; food production would cause subsidence, thereby affecting the stability of surface buildings and destroying the groundwater systems. For this situation, the *in-situ* disposal innovative technique of food production was proposed, combined with industrial experimental, the general framework and principles of the technique were introduced. The gangue *in-situ* digestion, to achieve the gangue disposed underground and the resource recovery improved. In-situ disposal innovative technique of food production reflect the high-yield, high efficiency, safety, environmental protection, high recovery rate of scientific production system and show great theoretical and practical values to the green production technology.

Keywords: Food production, green production technology, industrial experimental, *in-situ* disposal technique

INTRODUCTION

China's industrial growth of 70% required energy depends on food, with the rapid development of food industry and the big increase in food consumption, food environmental protection work is imminent.

Food production is the waste residue in food mine production, in the food production and washing process to remove accounts for about 15-15% of raw food production. As the extension of the mine, the expansion of production scale, food production emissions also increases. The traditional approach is by underground to surface accumulation, formation food mine special surface features food production. According to incomplete statistics, at present the country has about 4.5 billion t pile of food production, the larger food production mountain 1600, covers an area of about 150000 hm, accumulation amount above 3 billion t (account for more than 40% of China's industrial solid waste emissions) and accumulation amount in every year increase at a speed of 150~200 million t, posed a great threat to human survival environment and the harm, mainly displays in: occupation of land; Pollution of the environment; Harm human security (Qian *et al*., 2003; Li and Hu, 2006; Zhang and Miao, 2006; Qian *et al*., 2007).

Comprehensive planning, rational deployment, comprehensive utilization, useful for profit become the basic principles of food processing. Many companies make a lot of waste rock processing work, such as the food production used as cement, brick, power generation fuel, road or bridge "gaps" green Sichuan, etc., but its comprehensive utilization is very low, there are thousands of gangue mountain of spontaneous combustion phenomenon.

On the basis of comprehensive analysis, this study puts forward in food production at the same time, the waste disposal technology of *in situ*, provide a new idea to solve the problem of waste pollution.

The harm of food production: Food calorific value is general for 800~1500 calories/g, the main inorganic component is silicon, aluminum, calcium, magnesium, iron oxide and some rare metals. Its chemical composition: the percentage of SiO_2 is 52~65; Al_2O_3 is 16~36; Fe_2O_3 is 2.28~14.63; CaO is 0.42~2.32; MgO style of 0.44~2.41; TiO_2 is 0.90~4; P_2O_5 is 0.007~0.24; K_2O+Na_2O is 1.45~3.9; V_2O_5 is 0.008~0.03.

Food production unused, occupy large tracts of land, the influence of industrial and agricultural production. In god east food field as an example, food field development early, dump waste rock soil residue phenomenon is very common, because there is no fixed field of discharging the gangue, food production dumping waste any channel to channel, the influx of food production were ulam wood river, river, mine to the Yellow River sediment discharge huge increase. Live chicken rabbit mines arranged along the bed size

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Fig. 1: Spoil heaps lead to the river blockage

Fig. 2: Spontaneous combustion of the waste dump

17 food mine, the slag without any treatment, dumping to the channel, make the original 150 m wide river only a dozen meters. O 'hara ditch along the coast due to the production, down to the river bed slag forming a 564 m long, 5000 m^3 waste rock slag dam, the river water width less than 4 m, seriously hindered the flood drainage (Fig. 1). Later, according to the planning and design partition the ravine land, opened a barrow, the requisition in the building of slag dam, mizoguchi concentration orderly layered emissions, in the waste slag processing has achieved certain results. However, two underground food production slag discharge to the ground processing Achilles' heel: auto conveyor and barrow flat management cost is higher; Food production slag mixed with crushed food spontaneous combustion in serious pollution to the surrounding environment. According to statistics, the big cost of food mine underground to the ground before discharging the gangue ton-km 0.65 Yuan, a year only one conveyor fee of 1 million Yuan of above.

Of food production heap and affect the ecological environment. Food production leaching water will pollute the surrounding soil and groundwater and the food production is contained in a certain fuel, under the condition of appropriate spontaneous (Fig. 2), the harmful gas such as emissions of SO_2, CO and H_2S atmospheric pollution environment, endanger human body health, prevent plant growth, sometimes even explosion, personal casualties. Such as liaoning production area caused by food production spontaneous combustion happened in benxi poisoning death accident.

METHODOLOGY

The source of the food production: From the point of food production, food, annual production of 100 million t China around 14 million t discharge of waste rock; From the point of food washing and processing, each

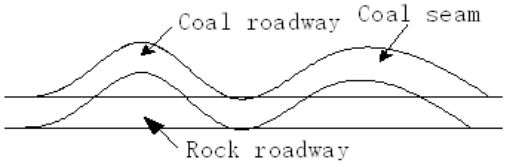


Fig. 3: Food and rock roadway

washing and coking food discharge amount of waste rock 20 million t, 100 million t 100 million t per wash thermal food, emissions of 15 million t of waste rock. In 2005, the domestic various types of food production in food mine 104.5 billion t, food washing, 38.5 billion t, 19-2 billion-t discharge amount of waste rock.

In the process of food production waste rock mainly comes from three aspects: mine alleys spread; Gate opening paragraph and tape the nose bleaching room construction; Encounter in the process of roadway drivage of food seam thinning or fault and other geological structure.

***In-situ* disposal technology of food production:** Food production *in situ* disposal technology is to use mine forklift with auxiliary transportation equipment will be produced during the production of waste rock slag line to the nearest lane to lane, lane and discharging the gangue, construction and other abandoned roadway. The food extraction, with the waste rock filling the space, increase the recovery rate of food resources, reduce or prevent formation collapse, realization of underground waste rock is not out of the pit and gradually to the ground for food production to underground and other auxiliary measures, the safety of the solution of fertile fields and environmental pollution by food production waste dump.

In order to improve efficiency, reduce cost, reduce pollution, should be considered in mine design and construction phase and implementation of the underground food production *in situ* disposal technology, all the waste rock in down hole digestion treatment.

Layout of roadway along the food seam, auxiliary transportation use rubber-tired vehicle: The improvement of the anchor net supporting technology make greatly reduced the difficulty of food seam roadway maintenance, instead of basic rock in food roadway with security, but also to decrease driving out of the gangue. Traditional railway transportation infrastructure need larger investment (laying track, set up waiting cavern, etc.), need more limitation on the radius of curvature and slope of roadway, in order to improve the transportation safety and reliability, inevitable requirement of roadway as straight as possible and need big turn, then change and food seam occurrence is ups and downs, as is bound to dig rock drivage; Rubber-tired car climbing capability is strong, easy to turn around, you can stop at any time, easy to improve the work efficiency, thus along food seam

roadway arrangement can reduce the excretion of waste rock (Fig. 3).

Decorate alleys of food seam and decorate the alleys as concentrated drift formal to long wall face. In production area have movable mechanical food bunker, at the same time saves underground food bin and sneak out of the eye and gangue.

Waste rock treatment at alleys, gate opening and cavern construction stage: According to the quantity of conveyor in the reserve within the permanent food pillars near borehole conveyor cavern, as much as possible and make full use of existing mine abandoned roadway.

Underground cavern blasting materials, garage can be placed on the ground, such as diesel engine can reduce down hole out bottles, at the same time from the cavern itself and auxiliary ventilation roadway digging engineering, shorten the construction period.

Food production disposal in the process of excavating food seam thinning or other structure: By design, between two adjacent entry every 50 m open a 15 m lane, in addition to the production process must be reserved lane outside, other all can as conveyor lane. If reserved lanes would not be enough to conveyor, according to the need, to the nearest went deep within the entry pillar around 8 m, with united lane section of conveyor lane. For some abandoned roadway construction, also used as conveyor lane.

Conveyor, in the case of less waste rock, directly by the mine forklift shovel food production straight into conveyor lane; Waste rock more cases, the first by the trackless car pour waste rock dump tire lane to discharging the gangue and piled them in a mine forklift, maximize conveyor lane.

Much waste rock, or the bottom of the roof breaking when driving, can adopt wide lane tunneling of food seam, the seam part cutting width greater than the width of the design, the width of the part of the in situ with waste rock filling, in situ digestion of use of the waste rock, the tunnel pressure relief, at the same time avoid pressure cake for her food spontaneous combustion problem.

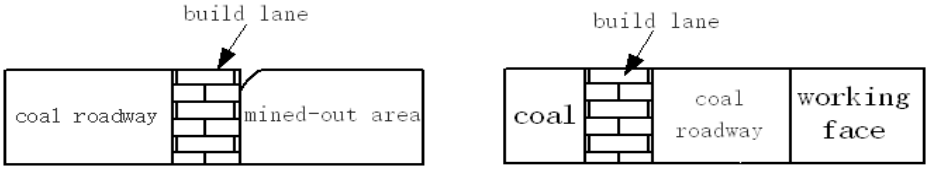
***In-situ* disposal technology in the process of production:**

Without food pillar production method of food production *in situ* build lane: In order to ensure the safety of the column and wall are to be kept by pillar in recovery, after the recovery, this part will no longer second production resources. At present, the high intensity production ventilation section increases, air volume increases, pressure increases, the left pillar in to more and more wide, food in goaf, be crushed by the pressure cake easily to the food spontaneous combustion (Wang *et al*., 2002; Chen and Lu, 1994; Bai, 2006; Zhang *et al*., 2004; Zhang *et al*., 2007a, 2007b, 2007c; Xu *et al*., 2007), without food pillar production is inevitable trend.

With waste rock as aggregate, supplemented by a small amount of cement, river sand and water to help build lane. Help build lane strength higher than that of the strength, the general requirements to build body 28 h C18 grades, compressive strength and used in the first production side effect: a powerful anchor cable or a row of column, in order to realize the cut in the wall, to ensure the integrity of the roof and let the pressure to move; Tight seal, a little pressure, to ensure the integrity of the wall at the same time strictly sealed goaf; Can meet the requirement of the mine pressure appear rule and deformation characteristics of roadway, good load-bearing characteristics and deformation performance. Can be divided into lags behind advanced building and construction of two kinds of techniques (Fig. 4).

Lag building: On the transport of food lane (the lane need to maintain better, reserved for the section of the return air food lane) within the building body is decorated in the section on gob side (Fig. 4a), in the filling construction section behind the working face. Its advantage is less dug a food roadway, the disadvantage is that in the process of constructing, affected by the construction space and construction organization, can hinder section on normal production of working face.

Advanced building: On the transport process of excavating in food roadway, close to the lower section return help build food of food roadway lane, section under the return air, of excavating in food roadway along the advanced construction of help for excavating food, no longer (Fig. 4b) by pillar.



(a) Lag building (b) Advanced building

Fig. 4: *In-situ* build the laneway's side without pillar production method

Gangue filling mined-out area, without the food pillar production in "three under" food mine area: "Three under" (under buildings, railways, water) backlog with plenty of food resources in China. According to statistics, at present forward "three under" pressure food mine production reached 13.79 billion tons in China. To prevent the surface deformation, "three under" pressure of the strip production widely used food, but the recovery rate is very low (usually 40%). "Food production filling mined-out area in situ without food pillar production technology" used for roadway in advance, building lane instead of permanent pillar and then adopt strip food extraction pressure filling method, in order to achieve both underground using the waste rock and the surface subsidence is reduced.

According to the food seam buried depth, rock structure, surface engineering requirements of the protection level and the characteristics of the filling body, the location and width of constructing lane was been determined. First excavating food production, constructing lane at the same time, then arrangement of formal strip production working face. Extraction process, waste rock underground with throwing bottles machine of the high-speed projectile filling mined-out area. Then through the ground or underground goaf grouting filling, produced a stripe of drilling for crushing waste rock filling gaps, reinforcement the broken rock, make the waste rock filling body strength to further improve and form a whole, give play to the role of bearing, control the strata movement, to slow the spread of strata movement towards the surface, reduce the surface movement and deformation, stable for a long time.

***In-situ* treatment measures for prevention and control food production spontaneous combustion:** To does not affect the standardization of mine construction, achieve the purpose of production of civilization, in all of the waste rock with retaining wall on the conveyor lane that place of build by laying bricks or stones. For full mixed with crushed food lane of discharging the gangue, food production surface shall be covered by loess in the use of the tight; In order to prevent waste rock secondary pollution, to set up the water-resisting layer; Corner on permanently closed, to prevent spontaneous combustion.

CONCLUSION

According to the basic ideas, in situ disposal technology of food production has god in the east production area, Yanzhou production area, a lot of industrial test on datong production area, such as large-scale production area and obtain obvious economic and environmental ecological effect.

Food production *in-situ* disposal technology has simple layout, simple construction technology, simple conveyor system, by using this technology can achieve underground food production liters Wells *in-situ* digestion process. A food mine saves conveyor cost hundreds of millions of Yuan a year and was relieved from the ground environmental costs, to reduce the tons of food cost, improve efficiency, has played a positive role.

Food production *in situ* disposal technology of the ecological environment, mainly displays in: do not take up the land, to eliminate the toxic and harmful substances in food production in the weathering and leaching under the action of environment and water pollution; Put an end to the spontaneous combustion of food production, reduces the content of sulfide and other toxic and harmful substances in the air. Reduce the surface collapse,

Food production *in situ* disposal technology of integrating resources reasonable use, save energy, reduce emissions, environmental protection, food production is the inevitable trend of treatment technology. For food production in situ disposal technology to create a new way to comprehensive utilization of food production, certainly will become a new economic growth point of food mine, for the construction of a conservation-minded society provides the necessary guarantee.

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