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STUDY ON SOME MODERN IRRIGATION SYSTEM COMPONENTS MANUFACTURING IN EGYPT

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ABSTRACT

The aim of this study was to evaluate two major types that used in modern pressurized irrigation systems (UPVC pipes and LDPE tubes made in Egypt). From all experiment steps data indicated that UPVC pipes fixed under soil surface (50, 100 cm depths), this type of pipes should be work under three forces, 1- Outcome pressure which deliver from systems pump, sometimes 50 meter head depended on systems design, 2 – Soil dry weight in range (1.5 kg sandy soil at 30 cm depth making a compact force for area below 50 mm diameter and 3 – Soil wet weight (soil + water (under saturated 1.9 kg wetted soil at 3o cm depth making a compact force for area below 50 mm diameter. All UPVC pipe pass in hydraulic test. To summarized the important part in UPVC pipes test. Hydraulic stander test should be include one extra recommendation that do the test of pressure procedure at one week; pipe should be test under three time of the nominal pressure. (Due to the force which face pipes when instillation)**.** LDPE work in the face of heat transfer which coming from two places 1- Directly from sun in summer average temperature in the area of study were 48°C. 2 – Heat transfer from soil and plant development in study area were in average, at summer at 10 cm depths was 28°C. This mean that for testing and classification the LDPE tubes. The chemicals and heat test will be the most important part in LDPE classification; add to that analyzing the row materials for carbon black percentage and others materials which mainly had the negative effect on LDPE performance. For the effect of heat the tubes life time was very small less than 5 years. Therefore Egypt LDPE and UPVC product should be developed under the supervision of research centers and modified some part in stander of calcification.

INTRODUCTION

Egypt has a population of 90 million, every one from population has 0.12 fed. and water amount was 750 m^3/ year. The water source in Egypt still limited in compare with population increasing. Therefore, the modification of water management in both old and new lands coming a major item in agriculture economy. The very important facts in farms management were to select the point source of water addition, on the other mean, to select the suitable irrigation systems design that achieve equilibrium plant among weather and soil conditions.

In this paper the focus will be in two major parts used in irrigation systems application; the UPVC pipes fixed at soil depths of 25, 50, 75,100 cm; and the LDPE tubes fixed at soil surface or subsurface (10; 15; 30 cm depth) the UPVC and LDPE tubes are made in Egypt from several years until now. To go through this study the following information will be important to follow the other steps of this research as following:-

1- Drip irrigation:

In a simplest form, it is an irrigation method using a system of perforated plastic pipes laid along the ground at the base of row of plants (trickle irrigation). In its more advanced form, it is a micro-irrigation in which water flow is very low, generally less than 20 l/h and without pressure drop by dropper. The water emerging infiltrates directly into the soil where it wets a volume of soil called bulb.

2- Sprinkler irrigation:

A method of irrigation under pressure in which water is sprinkled in the form of artificial rain through lines carrying distribution components: rotary sprinkler diffusers with permanent water stream, perforated pipes. In comparison with surface and drip irrigation, the length of the path of travel by the water drops through the air causes:-

a) Great sensitivity to wind, which reduces the uniformity of distribution.
b) Air condition effects on the crops if used in anti frost sprinkling or spraying.

3- low density polyethylene (LDPE)

Today, polyethylene manufacturing processes are usually categorized into "High pressure" and “low pressure" operations. The former is generally recognized as producing conventional low density polyethylene (LDPE). Polyethylene was first, produced by the high pressure process,. Ethylene gas could be converted into a white solid by heating it at very high pressures in the presence of minute quantities of Oxygen and having the following specifications:

1. Ethylene +
2. < 10 ppm oxygen
3. 1000 - 3000 bar
4. 80 - 300 C o = Polyethylene (LDPE).

4- High density Polyethylene (HDPE) :

It have the following specifications:

1. Ethylene +E
2. Al-based catalyst
3. 10 - 80 bar
4. 70 - 300 C o = Polyethylene (HDPE).

The emitters, laterals, sub-mains and mainlines are considered as principles parts of a trickle irrigation system. There are supporting parts such as filter, flushing units, pressure regulators, pressure gage, fitting, valves, fertilizer units, etc, that are used to serve different purposes in trickle irrigation system. (Awady, 1974).

The Hazen-Williams coefficient is not constant and varies with pipe diameter and flow regime. To improve the Hazen-Williams equation proper values of the Hazen-Williams coefficient should be selected corresponding to each lateral diameter.

The value of the friction coefficient (C) has strong influence on the friction loss calculation many friction loss charts for smooth plastic pipe were developed a (C) value of 150 but (Howell *et al.,* 1981) found that a (C) value of 130 in more appropriate for Reynolds number range countered in trickle laterals. The roughness coefficient at a maximum and recommended velocity value of 1.5 m/s depends upon pipe diameter with C=130 for 14-15 mm, C=140 for 18-19 mm, and c=150 for 25-27 mm for smooth plastic pipes (Anyoji, 1986).

Trickle irrigation system consists of a water supply and pump followed by a network of mainlines and sub mains, laterals, and emitters. The mainline is the primary artery for delivery of water to the various irrigation zones. Within each zone there are usually a number of sub-mains units. Sub-main units can consist of 2.5-12.5 fed; while a zone consists of 50-125 fed. (Bralts et al., 1987).The sub-main acts as a control system which can adjust water pressures in order deliver the required amount of flow into each lateral; it is also used to control irrigation time for individual fields.

The lateral can be a small plastic tube combined with emitters or simply a small thin walled plastic tube with orifice. The laterals are designed for distributing water into the fields with an acceptable degree of uniformity.

The design of trickle irrigation laterals need to consider the factor affecting the field Emission Uniformity (EU) and particular the variation head due to the elevation changes and head losses along the lines, as well as the emitter discharge variation at a given operation pressure depending on manufacturing variation, clogging and water temperature. (Wu 1997).

Due to friction losses, some variations occur in flow rates and, as a result of this, some important variations occur even if the conditions are same when Darcy-Weisbash and Hazen-Williams equations are used. (Demir and EU2, 1999).

The aim of this study was to evaluate two major types that used in modern pressurized irrigation systems (UPVC pipes and LDPE tubes) made in Egypt.

MATERIALS AND METHODS

Laboratory experiments were carried out at the National Irrigation Laboratory of Agricultural Engineering Research Institute (AEnRI). Dokki, Giza. The experimental work was divided into three parts. The first was survey collecting information in three items (private farms); to collect the following:-

1) System life times,
2) Percentage between UPVC and LDPE, in irrigation design; and
3) Percentage between UPVC and LDPE in systems replacements.

The second was hydraulics part to evaluate materials according to DIN STANDER the selected UPVC pipes and LDPE tubes, through hydraulic test at (AEnRI) burst test.

The third was to chemicals and physical properties to evaluate the classification of materials according identify stander for UPVC and LDPE tubes components.

Materials:

Hydraulic test by explosion test facility was used to test samples under pressure stages which were in between (0-60 bar) depend on the EGYTIAN; and DIN standards for un-plasticized Polyvinyl Chloride pipes;(ES 848-1-

2001) ministry of industry and Technological Development; (DIN 8061, 8062); and polyethylene tubes.

Explosion Pressure test facility using in measuring the maximum pressure which pipe afford.It consists of: Water tank, manual pump, 3 higher pressure pipe, 3 ball valves and 3 pressure gauges (10, 25, 60) bar. The pipe with one of the high pressure pipe, then raise the pressure in the pipe it tests with connecting using the manual pump and keep eyes on the pressure gauge until the pipe explode. It can explode on the length or the diameter of the pipe depended on the materials manufacturing. The burst pressure should be one and half time from the nominal pressure **(**the pressure which writes on the pipe or some time on the tubes).

The third part was to evaluate the UPVC and LDPE tubes to be under chemicals and physical test.

Physical test*:-* *measure* the pipe, diameter and thickness using tolls with accuracy of 0.001 cm; and weight using balance with accuracy 0.0001 gm; to compare sample collected with the standard specification which of as follow:

1-UPVC pipes standers:

Table (1): Egyptian standers (ES 848-1-2001); and DIN standers (8061; and 8062)

Nominal O.D. (mm)	Tolerance on O.D.(mm)	Class 1 (2.5 bar)		Class 2 (4 bar)		Class 3 (6 bar)		Class 4 (10 bar)	
		Wall (mm)	Wt. (kg/m)	Wall (mm)	Wt. (kg/m)	Wall (mm)	Wt. (kg/m)	Wall (mm)	Wt. (kg/m)
25	±0.2							1.5	0.174
32	±0.2							1.8	0.264
40	±0.2					1.8	0.344	2.9	0.35
50	±0.2					1.8	0.422	2.4	0.552
63	±0.2					1.9	0.562	3.4	0.854
75	±0.3			1.8	0.642	2.2	0.782	3.6	1.22
90	±0.3			1.8	0.77	2.7	1.13	4.3	1.75
110	±0.3	1.8	0.95	2.2	1.16	3.2	1.64	5.3	2.61
125	±0.3	1.8	1.08	2.5	1.48	3.7	2.13	6	3.34
160	±0.4	1.8	1.39	3.2	2.41	4.7	3.44	7.7	5.47

LDPE standers for diameters 16 mm. PN 2.5 bar; thickness 1.2 mm; PN 4 bar thickness 1.5 + 0.2; the weight for 400 meter = 15 kg.

The Chemical test was conformed using; Sulphoric acid (93.5 % for 72 hours); only for UPVC test, Acetone effect (2 hours) *and* heat reversion (15 min. indirect).

UPVC samples in ring shape depended on pipes diameters with thickness 7 cm. but for LDPE tubes samples length 10 cm. All the test according to international stander, at temperature 23° C and humidity 50 %.

Two classes of polyethylene are now made in Egypt, (variety of products); These are low density polyethylene (LDPE), high density polyethylene (HDPE).Three types of LDPE tubes were used in this experiments all the selected tubes were in the same diameter of 16 mm; but with different classification (leaky pipe, built in emitters; and the latest tube without emitters); all samples have diameters 16 mm; and the most part from irrigation systems replacing every two or more depended on the materials which made from, four diameters from UPVC pipes were tested (32-50-75 and 125mm) In this experiments, as a major components in irrigation systems (main and sub-main lines design).

RESULTS AND DISCUSSION

Irrigation performance assessment has been given the highest priority in irrigation research among other research priorities needed to solve the problems of irrigation development and management in Egypt. Performance of irrigation agriculture which includes irrigation methods or system must be improved in order to have additional food per unit area for growing population in Egypt. It is obvious that many irrigation systems are performing below their capacities. This situation may lead to bad irrigation systems management which include (design; selected materials; installation); in irrigation network classification. Added to that no quality control in the irrigation market.

Survey Places in private farms in, Kaleopea, (Cairo/ Alex. Desert road), through years 2012-2014.

Table (2): shows comparing between UPVC pipes and LDPE tubes in the formation of network design. As percentage in use for the most survey area under this study between UPVC and LDPE in greenhouses, Horticultural farms, vegetables farms and landscape areas were (1 to 35); (1 to 15); (1 to 30);and (3 to 1) m/ design ratio respectively. In the second comparison in system life times; in greenhouses was (18 to 5), Horticultural (22 to 3), vegetables (18 to 3) and in landscape (25 to 4) design respectively.

Table (2): Survey: for local irrigation systems components. (All data expressed as average)

Item	Green houses	Horticultural Farms	Vegetables Farms	Landscape areas
UPVC : LDPE (meter/ design) ratio	1: 35	1: 15	1: 30	3 : 1
System life time (year)	18 5	22 3	18 3	25 4
Percentage in change	1: 4	1: 8	1: 8	1: 6

In the third comparison between UPVC and LDPE in change through years the percentage was 1/4; 1/8; 1/8; and 1/6 respectively. From the last data present in table (2). It is easy to mark that UPVC was the lost values in replacement and in first installation in compare with LDPE which was in the highest values in the same items of comparison. but in the other item of this survey the LDPE was the lost in system life time in compare with UPVC pipes this may be lead to:

1- The LDPE have direct contact with direct heat transfer from both soil and air layers which mainly affect on both flow through tubes; and materials hardness;
2- UPVC already avoiding all this effect in case of installed below soil surface at accurate depth but under force of soil and water weights.

Table (3), shows the physical tests for the most common UPVC pipes. All samples were selected random from all farms. Through these measurements, one sample was unacceptable (75 mm). The ES in the areas of study and DIN standers for this sample was, outer diam = 75 mm with tolerance ±0.3, thickness 2.2 mm for PN 6, but in this case the inner diam + thickness 69.15 mm. This may be lead to there is no quality control in products source, also the negative effect will happen in both pipes flow rates, and water velocity when the pipes carry out the water from point to another through irrigation cycle. On the other mean, it may be get irrigation system non efficient comparing with other samples all were acceptable due to standers.

Table (3): Average physical UPVC pipes test; (32, 50, 75, 125 mm PN 6)

No. of sample	PN Bar	Outer diameter (mm)	Thickness (mm)	Inner diameter (mm)	Acceptable or Unacceptable
1	6	32	2.0	29.5	Acceptable
2	6	50	2.4	44.9	Acceptable
3	6	75	2.2	64.75	Unacceptable
4	6	125	3.464	119	Acceptable

Table (4) shows the physical test for the most common LDPE tubes. All samples were selected random from all farms in the study area. Through this measurements, four sample were unacceptable include the leaky tubes. The standers for this samples was, outer diam. =16 mm with tolerance ±0.2; thickness 1.2 mm. for PN 2.5, but in this case the inner diam. + thickness 12.96 mm for the sample (6) with built in emitters (**E_D**) of 30 cm.

Table (4): Average physical LDPE tubes test
(All samples have the same diameters of 16 mm)

No. of sample	PN bar	Outer diameter (mm)	Thickness (mm)	Inner diameter (mm)	Acceptable or Unacceptable
1	2.5	16	1.38	13.6	Acceptable
2	2.5	16	1.19	13.9	Acceptable
3	2.5	16	0.99	13.35	Unacceptable
4	2.5	16	1.1	11.9	Unacceptable
5 E_D= 0.5 cm	2.5	16	1.2	13.85	Acceptable
6 E_D= 0.3 cm	2.5	16	1.21	12.56	Unacceptable

E_D = emitter distance along tube.

Also regarding to other unacceptable data it may notes that the thickness and the inner diameters out of standers (The thickness and the inner diameters are the effective parameters in physical sample measurements to be acceptable or none). This may be lead to there is no quality control in products source. Also the negative effect will happen in both tubes flow rates, and water velocity (the major item in hydraulics evaluation), when the tubes carry out the water from emitters point to another through irrigation cycle. By other mean it may be get irrigation system inefficient. Comparing with other samples all were acceptable due to standers.

Table (5) presented average measurements for all samples which collected random from study area. All local UPVC pipes which made in Egypt pass in all tests; except pipes 75 mm which was out of standers in physical measurements; but here there was a question! How for some sample drop in one test stage and pass in other. Easy to answer this; there were a different in evaluation test between UPVC pipes which fixed under soil surface (50, 100 cm depths), this type of pipes should be work under three forces: 1- Outcome pressure which deliver from systems pump, sometimes 50 meter head depended on systems design, 2– Soil dry weight in range (1.5 kg sandy soil at 30 cm depth making a compact force for area below 50 mm diameter, 3– Soil wet weight (soil + water) under saturated 1.9 kg wetted soil at 3o cm depth making a compact force for area below 50 mm diameter.

Table (5): LDPE and UPVC in some physical, chemicals, and hydraulic average tests:

Pipe; tube diameter	Average of thickness (mm)	Explosion test (bar)	Sulphoric acid	Aceton	Heat	PN
Leaky tube	2.2	-----------	------------	Unaccep	Unaccep	----
Built- in 16	0.9	12	-----------	Unaccep	Unaccep	2.5
Tube 16 mm	1.2	14	------------	Accept	Accept	2.5
Pipe32mm	1.6	23	Accept	Accept	Accept	6
Pipe 50 mm	1.8	25	Accept	Accept	Accept	6
Pipe 63mm	1.9	25	Accept	Accept	Accept	6
Pipe75 mm	2.2	32	Accept	Accept	Accept	6
Pipe125mm	3.7	38	Accept	Accept	Accept	6

All UPVC pipe pass in hydraulic test; all pipes PN 6 and should be pass explosion test one and half from nominal pressure = 9 bar as ES, and Din standers test mentioned above. To summarized the important part in UPVC pipes test was the hydraulic test but with one extra recommendation do the test of pressure at one week; pipe should be install under three time of the nominal pressure; du to the force which face pipes when instillation.

For LDEP data in table (5) shows that two samples were unacceptable (leaky tubes, built in emitters) because under aceton and indirect heat the materials completely damage for both (lot of recycle materials may be added to the row materials. Extrusion compound should be containing 2.5 (± 0.5) by mass of carbon black complying with the following requirements density 1.5 – 2.0 g/cubic cm. The rating for dispersion of carbon black should be 5 or less

(According to DIN stander). When viewed without magnification the internal and external surface of the pipes shall be smooth, clean and free from cavities and other surface defects to an extend that would prevent conformity of the pipe to this standard for average two depths. Added to that LDPE work in the face of heat transfer which coming from two places:

1- Directly from sun in summer average temperature in the area of study were 48°C, and
2- Heat transfer from soil and plant development in study area were in average, at summer at 10 cm depths was 28°C. This mean that for testing and classification the LDPE tubes the chemicals test will be the most important part; add to that analyzing the row materials for carbon black percentage and others materials which mainly had the negative effect on LDPE performance. For the effect of heat the tubes life time was very small.

CONCLUSIONS

To summarize the important part in UPVC pipes test. Hydraulic stander test should be include one extra recommendation that do the test pressure at one week. Pipe should be test under three times of the nominal pressure, due to the force which face pipes when instillation.

To classification the LDPE tubes the chemicals test for LDPE will be the most important part; add to that analyzing the row materials for carbon black percentage and others materials which mainly had the negative effect on LDPE performance. For the effect of heat the tubes life time was very small.

REFERENCES

Anyoji, H. (1986). Comprehensive design of drip irrigation lines in a sub-main unit. Bull. Nat. Res. Inst. of Ag. Eng. 25:153-209, Japan.

Awady, M.N. (1974). Irrigation with the trickling method, Agent. Magazine, MOAW, S. Arabia 2 (6): 18-22 (In Arabic)

Bralts, V. F.; D.M. Edwards and I.P. Wu (1987). Drip irrigation design and evaluation based on the statistical uniformity concept. Advances in irr; volume 4 : 67 – 117.

Demir, V. and E. U2 (1999). A research on the determination of the technical properties and frictional losses of the components used in micro-irrigation systems 7th I.Congon Mech and Energy in Ag: 84-89, Adana.

Howell, T.A.; D.A. Bucks and J.L.Chesness (1981). Advanced in trickle irrigation. Irrigation challenges of the 80's proc. Nat. Irrig Symp.2nd oct. 20-23, Univ. Nebraska, Linco (n 6-81).

Wu, I.P. (1997). An assement of hydraulic design of micro irrigation systems. Agric. Water manages. 32:275-284

دراسة علي بعض مكونات شبكات الري الحديثة المصنعة في مصر

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باحث بمعهد بحوث الهندسة الزراعية – مركز البحوث الزراعية

نظراً لمحدودية الموارد المائية مع تزايد السكان وبوادر الأزمات المائية بين دول حوض النيل (المصدر الرئيسي للمياه في مصر) فإنه أصبح من الضروريات الملحة تعديل السياسة المستقبلية لإدارة المياه زراعياً في الأراضي المصرية القديمة والجديدة كبنداً رئيسياً في الإقتصاد الزراعي. مما يعني تحديد نظام الري الزراعي المناسب ووضع التصميم الهيدروليكي لشبكات الري الحديثة بأفضل المكونات اللازمة لها تصنيعياً آخذين في الإعتبار الظروف المناخية والطبيعية للنبات والتربة والظروف الإقتصادية لإنشاء شبكات الري وتشغيلها وصيانتها (لزيادة كفاءة آدائها وعمرها الإفتراضي) مما ينعكس علي الأسعار الزراعية التسويقية.

*الهدف من الدراسة:- هو تقييم نوعان رئيسيان (المواسير البلاستيك UPVC و أنابيب " خراطيم " البولي إيثيلين "منخفض الكثافة" LDPE) كمكونات رئيسية من المكونات الأساسية (مصرية التصنيع) والتي تستخدم في شبكات الري الضغطي الزراعية الحديثة. وذلك من خلال مسح ميداني لبعض المزارع ونظم الري الحديثة بها وعمل الإختبارات الهيدروليكية والفيزيائية والكيماوية (الجزء الأكثر أهمية) والتي تؤثر إيجابياً أو سلبياً على الأداء والعمر الإفترضي الإقتصادي للمواسير البلاستيك والخراطيم البولي إثيلين المنخفض الكثافة.

وفي هذا البحث تم التركيز علي المكونين الرئيسيين المستخدمين في نظم الري الضغطي الحديثة بناءاً علي آخر ما تم التوصل إليه في مصر من طريقة تركيبها وأعماقها المختلفة لإستخداماتها والتي كانت كالتالي:-

- مواسير UPVC الثابتة في أعماق التربة (٢٥، ٥٠، ٧٥، ١٠٠ سم).
- أنابيب " خراطيم " البولي إثيلين المنخفض الكثافة LDPE الثابتة على سطح التربة أو التحت السطحية علي أعماق (١٠ ، ١٥ ، ٣٠ سم).

وقد أجريت التجارب المعملية في المعمل القومي لإختبار مكونات شبكات الري بمعهد بحوث الهندسة الزراعية AENRI))الدقي- الجيزة.

وتم تقسيم البحث التجريبي إلى ثلاثة أجزاء:-

١- عمل مسح وجمع المعلومات من مزارع وأماكن مختلفة لشبكات ري (الزراعات المحمية والمحاصيل البستانية والخضروات والمسطحات الخضراء) للوصول إلي:
- معدل التغيير لنظام الري.
- النسبة بين كل من UPVC و LDPE كمكون أساسي في تصميم نظام الري.
- النسبة الإحلالية بين UPVC و LDPE في إستبدال وصيانة الأنظمة (العمر الإفتراضي لها).

٢- الإختبارات الهيدروليكية لتقييم إل UPVC و LDPE المختارة " ضغط الإنفجار حتي ٦٠ بار".

٣- الإختبارات الكيميائية طبقاً للمواصفات المصرية لوزارة الصناعة ومعايير "المواصفات القياسية" المصرية (2001- 1-848 ES) والألمانية (DIN 8061-8062).

وكانت النتائج كالتالي:

١- بالنسبة لمعدل تغيير مواسير البلاستيك UPVC إلي مواسير البولي إيثلين LDPE كمكونين رئيسين في شبكة الري كانت:

في الزراعات المحمية نسبة تغيير ال UPVC : LDPE كانت ١:٤، أما في المحاصيل البستانية كانت ١:٨، و كانت في المحاصيل الحقلية ١:٨، وبالنسبة للمسطحات الخضراء كانت ١:٦.

أما النسبة بين كل من UPVC و LDPE كمكون أساسي في تصميم نظام الري فكانت:

في الزراعات المحمية كانت ١:٣٥، أما في المحاصيل البستانية كانت ١:١٥، و كانت في المحاصيل الحقلية ١:٣٠، وبالنسبة للمسطحات الخضراء كانت ٣:١.

وكان العمر الإفتراضي بالنسبة لمواسير البلاستيك UPVC كانت: في الزراعات المحمية كانت ١٥-١٨، أما في المحاصيل البستانية كانت ١٦-٢٢، و كانت في المحاصيل الحقلية ١٥-١٨، وبالنسبة للمسطحات الخضراء كانت ٢٠-٢٥.

وكان العمر الإفتراضي بالنسبة لمواسير البلاستيك LDPE كانت: في الزراعات المحمية كانت ٤-٥، أما في المحاصيل البستانية كانت ٢-٣، و كانت في المحاصيل الحقلية ٢-٣، وبالنسبة للمسطحات الخضراء كانت ٣-٤.

٢- أما بالنسبة للإختبارات الهيدروليكية والفيزيائية لتقييم إل UPVC فتم اختيار عينات عشوائية محلية الصنع بأقطار (٣٢-٥٠-٧٥- ١٢٥مم) وقد أجتازت جميعها الإختبارات طبقاً لمعايير "المواصفات القياسية" المصرية (2001- 1-848 ES) والألمانية (DIN 8061-8062) ماعدا القطر ٧٥مم كان غير مقبول من حيث الإختبارات الفيزيائية.

أما بالنسبة للإختبارات الهيدروليكية والفيزيائية لتقييم إل LDPE فتم اختيار عينات عشوائية محلية الصنع (خراطيم ري بالنشع- خراطيم ذاتية التنقيط - خراطيم سادة) بقطر ١٦ مم وقد أجتازت جميعها الإختبارات. ماعدا خراطيم الري بالنشع وخراطيم ذاتية التنقيط (٣٠سم) كان غير مقبول من حيث الإختبارات الفيزيائية.

٣- أما بالنسبة للإختبارات الكيميائية طبقاً للمواصفات المصرية لوزارة الصناعة ومعايير "المواصفات القياسية" المصرية (2001- 1-848 ES) والألمانية (DIN 8061-8062) فقد اجتازت جميع العينات الإختبار ماعدا خراطيم الري بالنشع وخراطيم ذاتية التنقيط.

التوصيات:- مما سبق يتضح أن الجزء الأكثر أهمية للتصنيف هو اختبار المواد الكيميائية لأنابيب البولي إيثلين LDPEمن خلال تحليل المواد الخام " نسبة الكربون الأسود والمواد الأخري" واختبار التأثير الحراري.

ويفضل عند اختبار المواسير البلاستيك UPVC فى الا ختبار الهيدروليكيً زيادة زمن وضع المواسير لمدة لا تقل عن أسبوع تحت الإختبار وذلك نظراً لتعرضها الدائم لإجهادات خارجية والتي منها علي سبيل المثال وليس الحصر وزن عمود التربة ووزن عمود الماء.

لذا ينبغي وضع المنتج المصري من المواسير البلاستيك وخراطيم البولي إثيلين تحت المراقبة الدائمة والمتابعة وإشراف مراكز البحوث المتخصصة وذلك لعدم وجود مراقبة جدية صارمة للجودة في سوق تصنيع مكونات شبكات الري في مصر.

قام بتحكيم البحث

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